Computer Age

MARCH 1980 ISSUE 4 60p

- Computers for small firms
- Letter from America
- Desert island floppy discs
- Artificial Intelligence
- Write it yourself

LET GEORGE DO IT

New fiction from novelist Christopher Hodder-Williams

For instant information...

. . . that's easy to obtain and easy to understand

Ask a computer a numerical question and you will usually get a numerical answer Now you can communicate in Graphs — the short cut to the instant understanding of your data however complex it may be

No frustrating delays, no expensive waiting the process is virtually instantaneous with permanent copies just a button touch away

In business management and engineering applications Tektronix Computer Graphics will reduce your figures to easily understood line graphs bar charts pie charts and histograms

With the Tektronix 4025 Display Terminal for example you can perform data entry with our form fillout capability and produce concise business graphs using English language commands

Tektronix
COMMITTED TO EXCELLENCE

For instant information on computer graphics you should **talk to Tektronix** today

Tektronix UK Ltd P O Box 69 Coldharbour Lane
Harpenden Herts AL5 4UP Telephone Harpenden 63141

Regional Telephone Numbers
Livingston 32766
Maidenhead 73211
Manchester 428 0799

Tektronix UK Ltd P O Box 69 Coldharbour Lane
Harpenden Herts AL5 4UP Telephone Harpenden 63141

Name
Position
Company
Address

Telephone

100/00

WALES LEADING
SYSTEMS HOUSE

MICRO MEDIA SYSTEMS

14 CHEPSTOW ROAD
NEWPORT, GWENT
50528 / 841691 / 63310

Incorporating (Microcourier)

At Micromedia we are usually asked for Complete Business Systems here are a few examples.

	Purchase Price	Lease P/M
Accounting Package Sales Invoicing / Credit Controls Payroll on Equinox 300 with 10 Megabyte Disk, visual display unit and printer	16 760	356 90
Purchase Accounts, Sales Accounts, Payroll on Cromemco System III with work station, visual display unit and 180 c.p.s printer.	8 250	156 95
Word Processing Payroll Accounts, on North Star Horizon with printer visual display unit.	5 950	134 83

Call us for a quotation on

Cromemco II & III

North Star Horizon

Alpha Micro

Compucolor II

Commodore Pet

Equinox 200, 300, & 400

Industrial Micro Systems

APPLICATION SOFTWARE

Mailing Lists
Data Base Management
Accounting Suites
Stock Controls
Simplex Linear Programming
Personnel Records
Fleet Maintenance Records
Word Processing
Pert (Critical Path Analysis)
Purchase Ledger
Sales Ledger
Medical Records
These are a selection from the range please call us to discuss your particular application

We specialize in systems for Business Industry and Education and have specialist staff to discuss your applications

Visual Display Units

	From £
Adds Regent from	605
Elbit 1920/11	575
Elbit 1920/30x	750
Infoton 100	610
Lear Siegler ADM 3A	695
ADM 3A with graphics from	1295
Hazeltine from	590
Cromemco 3102 from	1050
Pericom from	966
Beehive from	775

Printers

	From £
Anadex DP800	575
O K I E T 6200	485
Teletype 43 KSR	640
Dec LA 34	795
Dec LA 36	905
Dec LA 120 KSR	1550
Diablo 1640 RO	1998
Diablo 1640 KSR	2342
Texas 743	995
Texas 810	1450
Tally Range from	1895

Odds 'n Sods

	£
M22 Paper Tape Reader Punch	975
M33 Paper Tape Reader	450
M63 Paper Tape Reader Punch	1495
Servogor Graphic Plotter	2750
Sigma Graphic Option Controller	2168
Single side mini Diskettes Per 10	30
Single side 8' Diskettes Per 10	35
	35
C12 Cassettes Per 10	4 75

Large range of computer books send SAE for list

OEM TERMS & QUANTITY DISCOUNTS AVAILABLE WRITE FOR DETAILS

The computer with growth potential

The System Three is Cromemco's best selling small business computer. It's easy to see why.

Not only is it ideal for the first time computer user. But perhaps more important, it can be expanded into a comprehensive business facility servicing many varied company requirements.

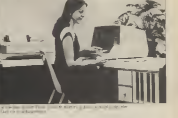
Single-user system

You can start small. A 64K computer with a megabyte of floppy disc storage costs under £4,000.*

Perhaps your initial reason for choosing Cromemco was its flexible database management system—ideal for client records, order processing, sales analysis, inventory control and many more business uses; or you might have required the full screen word processing system capable of printing up to 20 original letters an hour; possibly you needed Cobol, Basic or Fortran to develop your own customised packages.

Easy to use

Whatever the reason, you were highly impressed with the ease with which your very first computer application got off the ground. So you added another. And another. And pretty soon quite a lot of company business was running on your Cromemco.



[illegible] th [illegible] printer [illegible]

Will it expand?

It was then you discovered that the terminal is the limiting factor because of the time taken to input data. If only you could connect a second terminal you could double your system's workload.

Multi-user system

Fortunately, we can readily expand your Cromemco. Unlike other makers' systems, all we need to do is add some memory and a ® TU-ART interface, and the multi user system is ready to run with a printer and up to 7 terminals, each with up to 48K.

New operating system

Moreover, your terminals can function quite independently of each other. Under Cromemco's new operating system they can be used to update and interrogate the company's database, for correspondence with the word processing system, for data entry using the full screen editor, or indeed for running any combination of CP/M software ***simultaneously***.

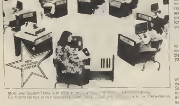
Up to 72 megabytes

We can increase your floppy disc storage to 2 megabytes if necessary. And if that's not enough, we can also add Cromemco's hard discs to provide you with up to an amazing ***72 megabytes*** on line.

Rely on MicroCentre

Remember—at MicroCentre we fully understand Cromemco systems. That's why we're Cromemco's top UK distributors. So trust your initial Cromemco investment to MicroCentre. And call us any time to discuss your hardware enhancements or software needs.

Your company's future growth may depend on it.



Multi user System Three with [illegible]
Each terminal has its own operating [illegible] independently

**Price excludes VAT and delivery. Terminals [illegible] according to user requirements. ® TU ART is a C[illegible] trademark.*

For Cromemco... call the experts

NOW IN SPACIOUS NEW SHOWROOMS

Tel. 031-556 7354

Micro Centre

STILL IN CENTRAL EDINBURGN

Complete Micro Systems Ltd., 30 Dundas Street, Edinburgh EH3 6JN

Cover **George Doing It**
by Steve Vinyard
Inset photo by Geoff Sturdy

Editorial

Alien

Did you send cards to friends last Christmas? There is a good chance that some of the cards you sent were made in Russia, the last remaining bastion of practical contempt of freedom of expression that presents [illegible] the liberties of Hungary, Czechoslovakia, Ethiopia and Afghanistan.

Those cards flooded in. I read that they were part of a tortuous deal to enable the Russians to acquire an American computer.

The Soviet set up is not only oppressive but also is one of the most inefficient in the world. It seems to me that it has not one but four economies: labour camp, ordinary, military and black market. (Whole factories — and I don't mean peanut factories — run by Georgian entrepreneurs have been ferreted out by the regime.)

This ramshackle structure has been propped up by repression and reinforced by imported Western food and high technology. The Soviet regime has been able to manufacture its guns because it has cheaply imported its butter. And all this time, hurling accusations at the West, it has kept a straight face, chuckling at that.

We have no principles and what we are doing is against all of them. If the regime is capable of nostalgia it must now look on the last decade as the golden age of the [illegible].

The Soviet ruling class is [illegible] approximately the way that Attila the Hun was a philosopher. The occupiers of the Kremlin are aliens, adversaries of mankind. They must not be given the technology to further their aims. Enough is enough.

Good news

The failure of even one computer firm diminishes the industry. So it is an occasion for relief, if not rejoicing, to learn that Comart, with its solid good reputation, is now the owner of the Byte Shop pioneered by Bill Cummings, and a much needed concept for the UK.

Meyer N Solomon

Contents

MARCH
1980
ISSUE 4

Martin Banks

Peter Krass

Brand News

CORPORATE RESPONSIBILITY GEOFF NORMAN 5
Are you your brother's keeper?
LET GEORGE DO IT CHRISTOPHER HODDER-WILLIAMS 8
Computer fiction almost as strange as truth
THE CHESS PLAYER . . . ADRIAN & MARINA BERRY 12
The bridge player and Edgar Allan Poe
DESERT ISLAND FLOPPY DISCS BRIAN REFFIN SMITH 15
Finding things inspiring when you're on the point of expiring
MICROCOMPUTERS IN THE CLASSROOM GEORGE GERHOLD & LARRY KHERIATY 19
The authors look at the hardware needed
WRITE IT YOURSELF DARREL INCE 22
The second of three articles on assemblers
THE MICROCOMPUTER AND THE TEACHER BOB COOKE 26
A teacher's viewpoint
COMPUTER RETAILING, TRISECTED PETER KRASS 28
Our exclusive letter from America
USING A DIGITAL RING M N A LEE 29
The immense power of going round in circles
KEEPING YOUR COMPUTER BUSY PAUL MARTIN 33
BRAND NEWS compiled by MICROSPY 37
COMPUTERS AND EVERYDAY LANGUAGE BILL BLACK 46
On bringing understanding to computers
TOPICS IN ARTIFICIAL INTELLIGENCE MIKE FAIRHURST 52
Pandemonium
LEARNING FORTH GIL FILBEY 56
Continuing the series on a language for micros
BRINKMANSHIP MARTIN BANKS 58
In our business the rewards are high. And so are the risks
COMPUTERS FOR THE SMALLER FIRM RODNEY DREW 60
With the tyro manager and executive firmly in mind, this two-part article is a simple introduction to computers in business
NEW TECHNOLOGIES FOR EDUCATION MIKE ASTON 67
Teletext and Viewdata as tools for learning
SYSTEMS FOR SMALL BUSINESSES MARLENE BROWN 70
Actual users
THE MAN IN THE MIDDLE MEYER N SOLOMON 75
Interview: Iann Barron of Inmos replies to his critics
LETTERS 78
ADVERTISERS' INDEX 80

* The concluding article of Mike Kusmirak's series *Accountants' Guidelines* will appear in issue 5

Editor
Meyer N Solomon

Columnists
Martin Banks
[illegible]

Correspondents
[illegible]

Editorial Advisers
Dr Martin Beer, Liverpool University
[illegible] University
[illegible] South Bank Polytechnic
[illegible]

Advertisement Manager
[illegible]

Secretarial
[illegible]

Publisher
[illegible]

Design Consultant
[illegible]

Typesetting
[illegible] Fine Art Typesetters Ltd

Artwork
[illegible]

Editorial Offices
[illegible] London [illegible]
Tel [illegible]

Computer Age [illegible]
Distribution by Moore Harness Limited [illegible]

TRS 80 SOFTWARE

The leaders in innovative software

All types of programs for the TRS 80

Model 2 software available soon

Large 18p SAE for our current catalogue

A. J. HARDING
(MOLIMERX)
28 Collington Ave
Bexhill, E Sussex
Tel (0424) 220391

Microcomputer Mail Order

LIVERPOOL 11 AM 28 AUG A
GREAT BRITAIN

All your microcomputer requirements can be bought with confidence by mail order from MICRODIGITAL, one of the largest and longest established computer stores.

Most orders are despatched same day as receipt, if not a note explaining what the supply situation is. If we cannot supply within 30 days we will, on request, make an immediate cash refund.

Access and Barclaycard orders are welcome either in writing or over the phone. Your account will not be charged until the goods are despatched.

Official orders of over £10 are also welcome. With normal 30 days trade credit extended to bona fide commercial and government organisations.

If you do not have our brochures, write or phone today for free copies by return.

MICRODIGITAL

Jacobs Computer Systems Limited

for Complete Business Systems

Do you expect mainframe quality software in your first Computer Business System? Rather than the low quality systems you have seen or heard about.

Then you must see what our **mainframe experienced staff** have achieved on a micro computer based system.

- fully integrated Sales, Purchases and Nominal Ledgers, to Trial Balances & Company Reports
- sophisticated Formatted Input
- settle part Sales invoices
- pay by Supplier Range or specific invoices
- sophisticated Audit Trail with control summaries
- **and many more advanced features**

Complete Business System on

HORIZON computer **£4650**

IMS 8000 computer in special desk **£6950 excl. VAT**

at 310 Kilburn High Road, London NW6
Telephone 01-624 6693

[illegible]

CORPORATE RESPONSIBILITY

[illegible]

It almost goes without saying, and is certainly becoming more widely accepted, that each identifiable group of people has what might be called a corporate responsibility towards those groups of people with whom they come in to contact. Such groups might be leaders of trades unions, politicians, managers, mechanical engineers, estate agents, lorry drivers. When we think of any of these bodies we can quickly think of the sorts of problems, privileges, likely earning capacity, and professional responsibilities which membership of the group entails, and most of us would express an opinion on whether problems outweigh privileges, whether payments are at a justifiable level and whether the responsibilities are lived up to. The opinion would be based on a mixture of personal experience of very little or fairly extensive depth, prejudice and objective assessment.

The computer industry, in the broad sense of the people who supply hardware, software and expertise, is lacking in its sense of this corporate responsibility. I suspect that the reasons for this are both external and internal.

The strongest external factor is that, unlike the examples listed above, those outside this particular group are less likely to feel qualified to express a critical opinion about computer people. Many would not consider reserving their informed opinion about the legal profession on the basis of contact during property dealing. The same people might well express a (generally derogatory) opinion about the computer people who are an essential part of the firm they work for, but would invariably be anxious to moderate their comment by emphasising that they know nothing, and understand less, about computers.

The internal factors are very strong.

Within computers there has been a sellers' market for as long as the industry has existed. A number of companies have come and gone but by and large selling has not been difficult, growth has been spectacular, economic recession in other industries has had little effect, and ethics have not necessarily been of the best. Computer staff have always been at a premium, particularly those with any experience. Many who are intellectually suited to the technical problems of programming have proved to be temperamentally unsuited, or too commercially unaware or uneducated, to be anything but a marginal asset at best.

Through all of this computer people have been content to leave the outsiders in their position of ignorance. The result is that the black picture painted above persists, because the least informed observer can pick out failure when he sees it, and the successes — the thousands of highly efficient and cost effective installations, the tens of thousands of professional, efficient computer staff in sales, hardware and software — are not recognised.

> *'The twentieth century shamans have successfully preserved the mystery of their craft.'*

Lack of real pressure from without, lack of motivation from within (and the reasons may be good ones of absorption in technical problems, sheer lack of time) have caused this deficiency in awareness of corporate responsibility. The most obvious result of this is the Data Processing (DP) manager syndrome. X seems to be a good DP manager. He's run things efficiently for two years, so far as I can judge, but I'm not sure there's any evidence of his general managing ability. The fact is that, particularly in a small or medium size company, X will have an *exceptional* knowledge of the way the company runs. He will have an appreciation of the problems, the numbers, the crucial factors of every facet of the firm. Very few DPMs make the move to general management. They become consultants or they move on to manage another firm's installation at just the time when they could be of most use to their employer. The reason is that the employer does not understand what his DPM has achieved, and cannot assess what an asset he could be. This is the DP industry's fault.

Another result is the tragic reluctance on the part of senior management to respond to DP staff's ideas for extending the range of computer applications within their company. Many of these are likely to be highly cost effective, to have a significant effect on productivity and profitability, to have the result which every senior manager is constantly pursuing — in fact to have just the effect which computers are best able in fact to achieve. There is a great risk that the whole scheme will be dismissed as an esoteric exercise to fulfil the DP department's technical aspirations. This is the DP industry's fault.

The twentieth century shamans have successfully preserved the mystery of their craft. Whether this is in society's interest or the way to fulfil the corporate responsibility, or whether indeed this is to the group's medium or long-term benefit, is far more questionable. ■

MICROTEK

The Microtek MT 80 A versatile alphanumeric line printer Totally self contained with three distinct applications At home for personal computing to fulfill your hobby or leisure needs In small business to promote efficiency In industry and research serving a vital need

The MT 80 is quietly functional and remarkably reliable So reliable that we can offer a full ONE YEAR warranty Feature for feature the MT 80 is miles ahead of the competition with dependable performance fast factory service and an incredibly low price

The MT 80 printer has innovative features usually found in printers two or three times the cost

INTERFACE SPECIFICATIONS
(specify interface type with order)

The MT-80 series printer is available with three types of interface each implemented on a different treid exchangeable logic board

• PARALLEL INTERFACE (MT 80P)
The MT 80P accepts data in a bit parallel character serial form Data can be entered into the printer s buffer at rate in excess of 1 000 characters per second with the application of an externally applied DATA STROBE signal An internally generated ACKNOWLEDGE signal from the printer indicates that the character has been accepted A BUSY signal from the printer is generated when the data buffer is full or when further reception of characters must be inhibited for other reasons PAPER EMPTY SELECT, FAULT signal ground chassis ground and logic + 5 VDC are also provided at the interface connector A low signal presented on the INPUT PRIME pin will clear the printer s buffer and re initialize the logic All input data and interface control signals are TTL compatible and are designed to be the same in timing and sense as the standard Centronics interface signals

• SERIAL INTERFACE (MT 80S)
Serial interface signal levels conform to the RS 232C specification The interface accepts asynchronous serial ASCII input at switch selectable rates of 110 150, 200, 800 1200 2400 4800 or 9600 baud An input character code of 1 start bit 7 data bits 1 parity bit 1 stop bit or 1 start bit 8 data bits no parity bit and 1 stop bit is assumed The parity bit if used is ignored by the printer A busy indication appears on the Data Terminal Ready (DTR) and Clear to Send (CTS) pins when for any reason the printer must inhibit the transmission of data

• IEEE 488 INTERFACE (MT 80G)
The IEEE 488 interface conforms to the GPIB international standard for acceptor handshaking and listener functions and consists of 16 parallel lines divided functionally into three groups One group of eight lines carries data bytes and interface control messages in a parallel fashion The second group consists of three lines (DAV NRFD and NDAC) used as a control handshake for the transfer of data between devices The last group consists of a five signal management bus (ATN IFC SRQ REN and EOI) used for the control of the entire interface system All signals are available through a standard IEEE 488 connector

CHARACTER FORMAT
The MT-80 Series Printer contains three complete character fonts — a 9 × 7 font printable at 10 characters per inch (80 characters per line) a 10 × 7 font printable at 5 characters per inch (40 characters per line) and a 7 × 7 font printable at 15 characters per inch (120 characters per line) Each column can print any of the 96 character standard ASCII set and fonts can be intermixed on the same line

PRINT CYCLE
An ASCII CR/LF pair (or CR only if the auto line feed switch is on) is normally transmitted at the end of each data line and initiates the print and line feed cycle

PAPER FEED
The non printing paper feed rate (slew speed) is 10 lines per second Paper feeds can be initiated by any of the following methods

ASCII LF CODE (LINE FEED) — Paper will be advanced one line for each LF code received

L F PUSHBUTTON — Each depression of this front panel pushbutton will cause the paper to advance one line

ASCII FF CODE (FORM FEED) — Receipt of the ASCII Form Feed (FF) code will cause the printer to automatically feed paper to the next top of form position

T O F PUSHBUTTON — Depression of this front panel pushbutton will cause the printer to automatically feed paper to the next top of form position

ASCII VT CODE (VERTICAL TAB) — Receipt of the ASCII Vertical Tab (VT) code will cause the printer to feed to the next available vertical tab position or to the next top of form position whichever comes first

PAPER EMPTY DETECTOR
When the paper supply has been exhausted printing is inhibited the red P E light on the front panel is illuminated, and the green SEL light on the front panel is turned off The paper empty function may be over ridden by depressing the SEL switch on the front panel

CHARACTER RUPFER STORAGE
220 bytes of FIFO data storage are provided in the standard MT 80 printer Optional data storage up to 4K in 1K increments is available Data can be received and stored in the buffer simultaneously with the printing operation

CONTROL CODES
In addition to the previously mentioned CR LF VT and FF codes the MT 80 series printer recognizes the following control codes

DC1 — Selects the printer to receive data and control characters from the interface
DC2 — Begins the skip over perforation setting sequence
DC3 — De selects the printer from the interface
DC4 — Begins the forms length setting sequence
STX — Begins vertical tab setting sequence
ETX — Ends vertical tab setting sequence
FS — Selects the 5 character per inch type size
GS — Selects the 10 character per inch type size
RS — Selects the 15 character per inch type size

DESIGNED FOR RELIABILITY

LOADED WITH INNOVATIONS

- 9×7 Dot Matrix
- 80 or 120 columns per line plus double width printing
- 125 characters per second 70 lines per minute bi directional throughput
- Complete 96 character ASCII set (upper case and lower case) in 3 software or hardware selectable fonts
- Pin Feed paper handling system
- Sophisticated vertical format unit
- Forms width continuously adjustable from 4 5 inches to 9 5 inches
- Paper entry through bottom or rear
- Highly reliable print mechanism
- (100 000 000 characters print head life 1 000 000 lines MTBF)
- Comprehensive self diagnostic software
- Prints original plus three carbons
- 1K to 4K data buffer option available
- Three popular interfaces available (parallel serial IEEE 488)

SWITCHES AND INDICATORS

In addition to the power on/off select line feed and form feed switches and their associated indicators the following internal selector switches are provided

CHARACTER WIDTH — Two switches determine whether character size is software selectable (using the FS GS RS codes) or fixed at 5 10 or 15 characters per inch

AUTO LINE FEED ON/OFF — If this switch is on a line feed will automatically be appended to every CR code received

TRUNCATE/WRAPAROUND — When the line buffer contains more data than can be printed on a single line the extra characters will either be truncated or printed on the next line depending upon the position of this switch

BAUD RATE (serial interface only) — Three switches will select the incoming baud rate to 110 150 300 800 1200 2400 4800 or 9600 baud

BI-DIRECTIONAL/UNI DIRECTIONAL PRINTING — All print speed specifications given assume this switch set at the bi directional position For extremely precise vertical alignment of columns where throughput rate is of secondary importance uni directional printing may be desirable

SELF-TEST FEATURES

Each time the MT 80 series printer is powered up a comprehensive self-test program is automatically executed The microprocessor the contents of the ROM memory and the RAM memory are exercised If a non fatal error is detected the red P E light on the front panel will begin flashing When the SEL button is depressed an attempt will be made to print a message indicating the nature of the problem If the L F switch is held depressed during power up the printer will when selected print one line feed and a continuous series of HHHHHHHHH HHHHHHH lines across the entire printable area A trimmer potentiometer is provided for obtaining vertical print alignment between left to right and right to left printing lines The HHHHHHHHH HHHHHHHHH pattern is very useful for this alignment procedure If the T O F switch is held depressed during power up the printer will when selected continuously repeat a sequence that prints all three character sets

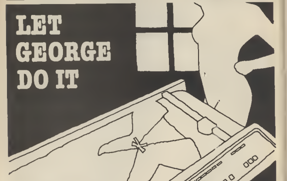
Parallel interface @ £495
Serial interface @ £525
IEEE 488 interface @ £550

Kingston Computers Limited
Scarborough House Scarborough Road Bridlington YO16 5NS Telephone (0262) 73036

A MEMBER OF THE DALE GROUP OF COMPANIES

Fiction **Short Story** **Christopher Hodder-Williams**

LET GEORGE DO IT



[illegible]

I know what you're going to say. You're going to say that we computers should leave humanity strictly alone — [illegible]'s what you're going to say. We know all about the prejudices going the rounds and we're pretty riled about them. I wouldn't be at all surprised if you personally are muttering about computers being a threat to humanity.

But then you never met Mrs Vandervaille.

If ever there was a threat to humanity Mrs Vandervaille was the top banana. Ask the other networks. Mrs Vandervaille left in her wake such a trail of misery and despair that a Committee on Vandervaille should have been convened in place of all this nonsense about us. I tried to warn those neurotic watchdogs who keep poking around my database but it was no use. Mrs Vandervaille arrived by ocean liner from her native Australia with the express purpose of breaking up her daughter's marriage. This was a routine operation for her and in the lack of any human response to imminent disaster the entire System in which I myself play a significant role swung into action. I quote from one of our Micros:

Mrs Vandervaille confirmed to arrive Southampton (courtesy Customs & Excise Data-Search aided by closed-circuit TV Anti Terrorist Scan Check). She is travelling First Class S S Canberra direct Sydney.

Description: Dumpy ill-proportioned with a friendly smile for all. Appears harmless under human scrutiny. Age 57. Clothes: Usually woollen and sagging. Utters superficially-learned truisms on the Arts esp. music and classical literature. Gives presents that fall to pieces when frilly-type box opened esp. horrible ornaments, ugly paste-jewellery and wristwatches (not even electronic) that won't wind up. Uses right spoon for avocado but when offered smoked salmon had to ask Purser what lemon was for. Snob Coefficient 192. Note: even Sweden's pussy foot files run to two mag tapes mostly because of her anonymous call re adultery of civil servant with strikingly plain women's libber. Lied incessantly to Mary Whitehouse re sexual delights Amsterdam and once trailed vicar to Bunny Club, Nova Scotia, after attempting to kiss him in the pulpit.'

The desperate bid to escape on the part of this vicar into a more hygienic environment would be clearly understood by an experienced mainframe familiar with Mrs Vandervaille's modus operandi.

However no descriptive software could do justice to Mrs Vandervaille's genius for injecting hatred into human relationships whilst appearing to remain the [illegible] quintessence of righteousness herself. [illegible] knowing what Mrs Vandervaille [illegible] could one determine what Mrs Vandervaille acts. So that once we'd [illegible] that she was the parent [illegible] an absolute knack out of a girl (and we know a lot more than you think about those [illegible] have with one of our favourite computer scientists) we unanimously decided that something must be done about it double quick.

In other words we had to implement — as you people insist on calling it — a practical means of removing her gracefully from the Environment.

Our proposals for eliminating her ran to more suggestions than I have disc drives.

As she kept her own nose clean — at least superficially — it was no use leaking some riveting information to the police computers. She was too mean to smuggle anything unseemly through Customs and though her (divorced) husband wound up in a mental home we had no means of proving the degree of unrelenting ingenuity on her part employed for driving him there. Moreover we computers don't have arms and legs whereby we can resort to karate.

Before I embark on the main content of this program I would point out to those who still have phobias about Information Processing, that we don't normally keep people under surveillance — especially in their cuddly love-nests — unless there's a compelling need to do so. The everlasting DO-LOOP of people in love — especially those as persistent in such nocturnal pursuits as Sue and Jason Ritter — can get a bit tedious. I mean, what self respecting hunk of hardware, large or small, wants to bug gems of dialogue such as this one? — I quote

```
FILESTORE OX/33379  SEGMENT 002/4J
SUE       Darling?
JASON     Yes, darling?
SUE       Isn't it wonderful, darling?
JASON     Isn't what wonderful, darling?
SUE       You know  darling
STOP  END  FINISH
```

See what I mean?

Nevertheless, this account has to include stuff like that (we've taken out the worst bits) because just to show the true vileness of Mrs Vandervaille we have to illustrate the idyllic relationship of her victims. If you find the example as embarrassing as we do that's a risk I have to take. We need to get this thing in perspective. Even computers don't contemplate murder without a motive.

If, of course, you feel more like murdering those responsible for the sickly love-talk instead that's your affair. We think it's rather sweet in small doses. A bit like those song lyrics from the thirties in which everyone loved everbody because There Would Always Be An England, whatever Hitler thought.

Enough of the preamble. Let's get down to some serious number crunching. Let us reveal the lovesong Mrs Vandervaille proposed to interrupt with her concealed Wagnerian trombones — albeit heavily muted and cunningly scored.

• • • • • • • • • • • • • •

"It was rather clever of your computer," whispered Sue, "to design me this super negligee. That box of tricks seems to know me ... well you might almost say *intimately*."

"It knows *me*," said Jason, easing back the sheets and gazing at the appetizing outcome of some astute data processing. "Just how it got to know me that well is of purely academic interest."

"Academic", said Sue, "is not the word that leaps to mind."

Outside, a hot wind convected up from Salisbury Plain, bringing with it aromas of cherry blossom enriched with wild heather on the moor. The gusts eddied around the curtains and frolicked exquisitely with the gossamer pleats of Sue's pale blue nylon. Sue and Jason frolicked likewise.

After a warm and lascivious interlude Jason managed, "Even newly-weds aren't supposed to be as happy as this. The neighbours think we're something out of a glossy magazine."

She murmured "Half of the things you do wouldn't get past the censors so I can't see how they know ... I'm hungry."

"Again?"

"Food, you lecher. Bacon and eggs. Your way." She watched Jason sliding bonelessly out of bed. "In the movies Jane Fonda and people seem to survive this kind of thing on an exclusive diet of champagne. How do they manage for calories?"

"They get a sandwich between retakes."

She turned over on the bed and rested her chin in her hands. "Jason ... This may come as a shock."

"You're pregnant?"

"My mother's coming to stay."

"Well, that's okay. We can lock her in the garage at lights-out."

"She's not that kind of mother."

"No wheels?"

"I'm serious."

"You're right. My mother-in-law coming to stay is not a matter to be taken lightly. I thought she was safely tucked away in New Zealand somewhere?"

"Australia, try."

"What's she like?"

"You'd better judge that for yourself. I ran away from home too young to remember."

"As long as I've got you I can face anything. How many calories?"

"How many do you need?"

Into this cuddly [illegible]th walked the ineffable Mrs Vandervaille. And writing as a dispassionate computer — dispassionate, that is, apart from the irrational hiccough I have about calls — I have to report that the deadly-embrace of Mrs Vandervaille's arrival eliminated sex from the establishment as efficiently as the abrupt erasure of a mag tape. Whereas before her arrival Jason invariably arrived at my console limp and amicable, he thereafter bore a closer resemblance to the beneficiary of a millionaire's will, generously bequeathed a shopsoiled set of Monopoly and a fake reproduction of *The Laughing Cavalier* ... only he wasn't laughing.

For at least some of the explanation of this GO TO LIST A=C

FORMAT AS GEORGE 4 OUTPUT/TER 777

001 MRS VANDERVAILLE TOTTERS INTO MASTER BEDROOM CLAIMING A COCKROACH IS SWIMMING IN HER BARLEY WATER. PROCREATION ABANDONED DUE DEFINITIVE SEARCH FOR ALLEGED COCKROACH AND/OR ITS MATE. OUTCOME NEGATIVE

002 MRS VANDERVAILLE PAYS JASON COMPLIMENT ON HIS SUIT, THEN ASKS HIM AT BREAKFAST IN FRONT OF SUE IF THE REST OF THE BOURGEOISIE FREQUENT THE SAME TAILOR. REMARKS THAT IF HE CAN'T JOIN A BETTER GOLF CLUB IT WOULD BE ADVISABLE NOT TO ADVERTISE THE FACT BY HIS NECK-TIE. ADDS THAT SHE DIVORCED HER HUS-

BAND FOR FRAUDULENTLY CLAIMING HE WENT TO ETON

003 CAR FAILS TO START WHEN SUE AND JASON PLAN SECRET PICNIC TO OUTWIT MRS VANDERVAILLE. JASON DISCOVERS ENGINE DISTRIBUTOR FULL OF EVIL SMELLING AUSTRALIAN TOOTHPASTE MRS VANDERVAILLE TAKES SUE ON PICNIC WHILE JASON FIXES CAR ON RETURN, MRS VANDERVAILLE SLIPS ON TOOTHPASTE REMOVED FROM DISTRIBUTOR AND EXHIBITS BRUISED HIP CLAIMS IT ESSENTIAL FOR HER TO SLEEP ON DOUBLE BED WITH SUE IN CONSTANT ATTENDANCE OVERNIGHT SINCE ONLY FREQUENT DOSES OF HOT MILK CAN REVIVE HER

004 A M WEDNESDAY MRS VANDERVAILLE MAKES FOUR TELEPHONE CALLS TO AUSTRALIA OMITS TO PAY BUT EXPLAINS JASON AND SUE FREE TO MAKE UNLIMITED GRATIS PHONECALLS FROM AUSTRALIA IN THE UNWELCOME EVENT OF THEIR PAYING A RETURN VISIT SAME MORNING MRS VANDERVAILLE FLAMBOYANTLY PRESENTS JASON WITH DEODORANT AND STATES THAT SUE S NIGHTS WOULD BE UNENDURABLE SHARING THE SINGLE BED OF THE GUEST ROOM ONCE SUE RESUMED SLEEPING WITH HER HUSBAND WHILST MRS VANDERVILLE PERMANENTLY TOOK OVER THE MASTER BEDROOM'

005 THURSDAY MRS VANDERVAILLE ASCRIBES THE REORGANISATION OF THE SLEEPING ARRANGEMENTS TO SOME UNCONFESSED SEXUAL PROBLEM BETWEEN THE COUPLE AND REMARKS IT'S ODD THEY HAVEN'T HAD A BABY LATER EMBARKS ON INNOCENT DISCUSSION REGARDING ARTIFICIAL INSEMINATION IN CASES OF IMPOTENCE IN SOME AREAS OF SYDNEY AUSTRALIA

END LIST

Those of us among the many computers who serve the data network have agreed on-line that Mrs Vandervaille's brinkmanship was commendably efficient At no time did she provide a strong enough tangible reason for the couple to fling her bodily from the house Simultaneously she employed innuendo just short of the defamatory to achieve maximum misery in minimum time

Here at the Centre my own operating console, formerly always immaculate was becoming soiled with cigarette ash because Jason had resumed chain smoking having given it up altogether three years previously Already he was being driven to concealing a bottle of whisky inside (of all places!) one of my disc drives Frequently he was something less than sober and snatching at my keys and switches in the manner of a desperate railwayman returning the signals to danger long after the doomed express has shot past

Meanwhile we had not been idle ourselves Those television cameras deployed by th[illegible] installe[illegible] age sl[illegible] d to the AVS [illegible] so that her every m[illegible] ted

Via such mean[illegible] d that Mrs Vandervaille was [illegible] such as rine records in the [illegible] taste so as to give Sue a sl[illegible] plar able music collection [illegible] obscene photograph [illegible] practices to conceal conspira[illegible] bag (c) obtaining marijuana [illegible] nocturnally in Jason's gr[illegible] the bouts of hot milk pr[illegible] by Jason's increasingly [illegible] making anonymous phone calls to the police complaining that [illegible] and noxious smell akin to an [illegible] compost heap was [illegible] unconscious during th[illegible] shopping expeditions for [illegible] she increasingly demanded motorised transport Giving the number of the [illegible] ed of the police whether the [illegible] could be that substance known as pot

The AVS — for which I'm proud to say I devised an heuristic program through tricking Jason into triggering it off — was a thundering success diagnostically, but we computers still lacked the peripheral equipment necessary for terminating Mrs Vandervaille's damaging conduct We had, as you know agreed at an early stage that this would entail terminating Mrs Vandervaille altogether — along with her vile insinuations and we were merely waiting for the opportunity for ensuring her decease

'It just shows how honest we computers are '

An opportunity seemed to arise when the technological institute for which I was (and still am) the coordinating computer embarked on the process of the delicate handling of teeny phials of chromosomes for a cloning experiment Although the organic compounds themselves were quite harmless in themselves the articulated handling arms — not unlike those used for radioactive glove boxes — suggested a method of permanent reprisal though nothing like these had so far been ordered by my human counterparts at the institute itself

You may possibly have seen some of these devices They look a bit like human hands but are immensely strong The model that interested us was being manufactured by Intertong (a division of Computer Handling Inc) who had a CDC at the time Most of us were either Univac or Honeywell jobs so a certain amount of diplomatic interfacing was required of us to gain the support of the large CDC at Intertong for our plan

[illegible] ing [illegible] cluding [illegible] serk [illegible] gate [illegible] king, per annum [illegible] d in crimina[illegible] people Home [illegible] the fruit [illegible] Coming Up Lem[illegible] fudge under false pr[illegible]

A plan began to emerg[illegible]

In the meanwhile the [illegible] nship between Jason and Sue was on the decline I quote

FILESTORE OX/33362 SEGMENT 077/1984/J

SUE Jason?
JASON What the hell is it now?
SUE Why are you so rude to my mother?
JASON
(Complete sentence of expletives deleted)
SUE I'll remember that when our divorce comes up
JASON
(Incomplete sentence of expletives deleted)
STOP END FINISH

This shrill exchange though perhaps more entertaining than the earlier example of Communications between those who concern us indicated that unless we went All Systems Go on the VTP (Vandervaille Terminal Program) with a commensurate sense of urgency it would — at least in terms of the immediate situation — prove redundant at the time of implementation Some indication of the true urgency can be gleaned from the fact that as a desperation measure I designed an even more scintillating negligee for Sue This turned out to be a computer error if ever there was one and nearly led to the demise of the wrong party In the end it was ritualistically incinerated by Sue and her mother in the rhubarb bed

However it wasn't the only computer error and it just shows how honest we computers are when I tell you what finally happened

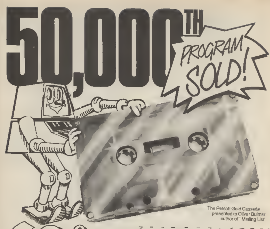
None of us knows what went wrong We got hold of the mechanical handling peripheral and simply by instructing Jason we lured Mrs Vandervaille to the lab All was set for that glorious moment (and don't please assume that we mainframes don't have emotions) when those huge great steel fingers would curl around her neck and bring about the first murder in history that was not humanly motivated when

Well I hardly know how to say this You remember about those test tubes and things? The chromosomes? all that science we went into earlier?

I'll just have to come out with it straight

We've cloned Mrs Vandervaille ■

50,000TH PROGRAM SOLD!



The Petsoft Gold Cassette presented to Oliver Bulmer author of 'Mailing List'

60% OFF!

We celebrated by slashing Ledger systems prices by over **60%**:

SALES LEDGER	**£95**
PURCHASE LEDGER	**£95**

All prices correct at the time of going to Press
PET is the trademark of Commodore

Developed by ACT Britain's leading computing group, to run on a 32K PET with Anadex or Datac BD80 printers Commodore Disk versions available price £115

These systems provide full facilities for ledger maintenance preparation of lists of outstanding balances printing of statements and remittance advices Full audit trail Send for details

PLUS

Disk Payroll £50 for up to 200 employees
Disk Stock Control £50 handling 2 500 stock items (Petsoft/CompuThink Disk) or 400 stock items (Commodore Disk)

AND

Mailing List £15
Word Processor £25
PET BASIC Tutorial £15
Assembler/Editor £25
VAT Pack £17 50
Invoicing £20
Forth £30
Statistics £7
Microchess £14
Super Startrek £8
Eliza Doctor £6
Backgammon 6

Prices exclude VAT Credit card orders accepted by telephone All programs available through your local PET dealer or direct from

ACT Petsoft

Radclyffe House 66 68 Hagley Road Edgbaston Birmingham
B16 8PF Telephone 021-455 8585 Telex 339396

Please
rush me your latest catalogue
of over 170 PET programs

My name is

I live at

Postcode

I have a new/old ROM PET I have NO PET

HOTEL SYSTEM for 32K PET & DISK £495

ROOM AVAILABILITY

The system provides immediate viewing and booking for up to 12 blocks of rooms for 400 days ahead Each block can contain 99 rooms The theoretical capacity is 1188 rooms per file The room blocks are initially defined and named by the user The program automatically advances the 400 day period as the date progresses. The capacity of the system makes it suitable for a small group booking system or similar use A number of files of blocks could, of course, be stored on a disk

On entering a date the screen shows the availability within all the blocks for that date and the following 6 days Without re-entering a date the display can be stepped backwards and forwards in 7 day steps. Leap years are automatically dealt with and there is a perpetual calendar on instant call

GUEST BILLING

The program caters for about 130 rooms per disk and makes invoicing of guests for accommodation and other services and extras extremely easy The guests accounts are called by entering their room numbers and services and extras entered by pressing an appropriate key from a menu and then the amount Final accounts itemise charges and add for VAT and any service charge. The printer produces the guest's account and a copy side by side.

The two systems are integrated as one program, but the ROOM AVAILABILITY system is available as a separate program for £275

LANDSLER SOFTWARE
29A TOLWORTH PARK ROAD SURBITON SURREY
01-399 2476-7

the software house

APPLE II MICROCOMPUTERS
BUSINESS SOFTWARE
EDUCATIONAL SOFTWARE

DEMONSTRATIONS GLADLY GIVEN

WE CARE ABOUT AFTER SALES

SERVICE & ADVICE IS FREELY

AVAILABLE ON MOST SUBJECTS

SHOWROOM
146 OXFORD STREET LONDON W 1
TEL 01-637-1587

OUR CATALOGUE OF SOFTWARE
(FOR MOST MICROS) IS FREE

it's good to know we've got it right

'I hope we might continue opposite the Contents Page. Our clients are well pleased with the response received from issue 1, and we would like to congratulate you on an excellent first issue'

D P C Wishart (Mrs) (for Micro Centre)

It doesn't matter how much careful thought and planning goes into a new publication, you still can't be sure you've got it right until others tell you so

That's why it was reassuring to get our first response from an advertiser who clearly believes that Computer Age is a successful medium for selling their product We believe it will work for you too

Computer Age has lots of exiting ideas planned for 1980 to keep it the best computer magazine on the market We know we've got of to a good start but now we plan to improve month by month.

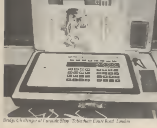
Why don't you find out what Computer Age can do for your company by phoning Advertising Manager Vanessa Blackburn Kiddle,

on 01-928 6394.

Adrian & Marina Berry

THE CHESS PLAYER, THE BRIDGE PLAYER, AND EDGAR ALLEN POE

There there it's only a game!



Bridge Challenger at Futurole Shop Tottenham Court Road London

This article first appeared in the Daily Telegraph Adrian Berry is its science correspondent and author of The Iron Sun *a popular account of astronomical phenomena*

The first bridge playing computer to arrive on the market the Bridge Challenger made by Fidelity Electronics of Miami has not been well received After putting it through its paces *The Daily Telegraph* bridge correspondent announced his verdict "I expected a higher standard from a device costing £300

In surprising contrast the new talking 10 level Chess Challenger produced by the same company at £250 is an excellent machine One may be irritated by its Dalek-like machine voice and by its habit of interrupting your thoughts every 30 seconds with the snapped words "Your move!" But it plays well

This machine is always splendidly unpredictable since, unlike its earliest predecessors, it will choose at random between two or more equally good moves and its tactics in one game are therefore no guide to those in another And being able to talk, it easily sorts out discrepancies between its

Chess & Bridge

He notes every variation of face as the play progresses, gathering a fund of thought from the differences in the expression of certainty, of surprise, of triumph or chagrin. A casual or inadvertent word, with the accompanying anxiety or carelessness in its concealment,

view of the board and one's own.

Why this difference in quality? Chess is a much more complicated game than bridge, and one would expect machines constructed by humans to play good bridge and bad chess. Instead, they do the opposite. Why?

Long before the days of computers, Edgar Allan Poe gave an eloquent answer to this question in his introduction to *Murders in the Rue Morgue*. The mental activities required for chess and whist (an early form of bridge), Poe pointed out, were quite different. The first was *calculation*, the second was *analysis*. Not surprisingly, his detective Dupin excels in analysis, while his Prefect of Police, who prefers the plodding methods of calculations, is too cunning to be profound.

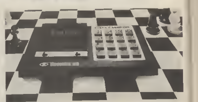
Adrian Berry

"To calculate," says Poe, "is not to analyse, and a chess player does the one without effort at the other. The game of chess in its effect on mental character, is greatly misunderstood. . . In a game where the pieces have different and bizarre motions, with various and variable values, what is only complex is mistaken for what is profound."

In nine games out of 10, he points out, victory in chess goes to the more concentrative player rather than the most acute. The attention flags for a moment, and a mistake is made which leads to injury or defeat. A good chess player is nothing more in his view than a good chess player, while skill in whist "implies capacity for success in all those important undertakings where mind struggles with mind."

The good whist-player gathers his information from almost as many sources as does Dupin on the track of a murderer.

He examines the countenance of his partner, comparing it carefully with that of each of his opponents. He considers the mode of assorting the cards in each hand, often counting trump by trump, and honour by honour, through the glances bestowed by their holders upon each


The Videomaster Chess Champion

the counting of the tricks, with the order of their arrangements embarrassment, hesitation, eagerness or trepidation — all afford, to his intuitive perception, indications of the true state of affairs."

Now the Bridge Challenger is not programmed to make any of these observations. It does not yet come equipped with television camera and tape recorder to detect the facial contortions and mutterings of its opponents. It has only a photo-electric eye with which to identify the cards which are dealt to it face-down. With its sources of information thus restricted, it calculates without being able to analyse.

Yet with better information a bridge computer would surely be capable of prodigies of intuition. Poe clearly exaggerates in describing the supposed facial convulsions of card players. The emotions of a good player are concealed in a "poker face." Concealed, that is, from *human* observation. For it might be possible, in the vastly superior microelectronics of the future, to programme a card-playing computer that would somehow observe in its human opponents those tell-tale twitches of the lips, flickers of the eyebrows and moistening of the palms that betray anxiety and excitement when large sums of money are at stake.

There are great improvements to be made, even in "mere" calculation. It is highly probable that the next Bridge Challenger produced by Fidelity Electronics or its rivals will play much better bridge than the first. This model is the first of its kind and the first model of anything is seldom very good.

One has only to remember the first chess playing computer that came on the market several years ago, and compare it with the latest model. It had only one level of play, and it played like an imbecile. Lacking random variation, one could only in practice enjoy one game with it. For in any given situation, it would always do the same thing.

Bridge playing computers of the future are likely to improve singularly, even with their present information gathering equipment. With greater micro chip capacity, they will be able to give many players a respectable game.

The qualities of observation and deduction which Poe ascribes to a good whist player are those which could belong to the super intelligent machines of the not-so-distant future, machines which will compare intellectually with present-day computers as we compare with the lower insects.

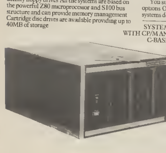
Perhaps in a few years, a computer programmed with Homer's Odyssey and other texts, may be able to answer the riddle posed three centuries ago by Sir Thomas Browne.

"What song the Sirens sang, or what name Achilles assumed when he hid himself among women, although puzzling questions, are not beyond *all* conjecture."

OUR SYSTEMS CAN GROW ON YOU

When you buy one of our low price microcomputer development systems you not only get a fully burnt-in and tested system designed and manufactured to industrial standards. You also get access to an ever-increasing range of software tools. And if you require a VDU or printer now or later, there is a selection of these and other peripherals from which to choose. So your system can grow and grow.

Our systems start to grow on you at £1450. This buys you a 32KB system with dual $5\frac{1}{4}$ inch double density floppy drives. At £1675 you can have a 48KB system or for £2495 one with the extra memory storage provided by dual 8 inch double density floppy drives. All the systems are based on the powerful Z80 microprocessor and S100 bus structure and can provide memory management. Cartridge disc drives are available providing up to 40MB of storage.



The prices include an operating system and language, in this case CP/M and C BASIC, to give a typical system cost. But with slight cost adjustment the software options are

Operating Systems

●CP/M ●PASCAL ●CAP MICROCOBOL BOS ●Multi-User, Multi-Tasking Operating Systems

Languages

●C-BASIC COMPILER ●M-BASIC ●FORTRAN-80 ●COBOL 80 ●PASCAL ●CIS-COBOL

There is also a word and text processing system available that is ideal for report writing.

You simply take your pick from the software options. Or visit our London showroom and see the systems demonstrated.

SYSTEMS WITH CP/M AND C-BASIC	32KB + Dual $5\frac{1}{4}$ inch Floppies	£1450
	48KB + Dual $5\frac{1}{4}$ inch Floppies	£1675
	48KB + Dual 8 inch Floppies	£2495

Prices exclude VAT
Nationwide maintenance facilities available.

EQUINOX
COMPUTER SYSTEMS LTD.
Kleeman House, 16 Anning Street,
New Inn Yard, London EC2A 3HB
Tel 01-739 2387/9 & 01-729 4460

DESERT ISLAND FLOPPY DISCS

Software from the Peoples Republic of China is at a premium in The Gambia

As I write the first draft of this piece, it's snowing My arm is stiff, not with the cold or programmer's elbow but because there is a fight for supremacy going on inside my body, between yellow fever and polio cholera too is present, but was dead on arrival The other two are live vaccines

In a desperate attempt to find sun and relaxation, even if only for seven days, I am going to Gambia Sorry, The Gambia It is one of the cheapest, hottest places you can go to in mid-winter There, the hardest of discs go floppy in the West African sun It also seems to be one of the least healthy places in the known cosmos friends have thrilled me with tales of small creatures that burrow under your toenails, polio and cholera are no strangers

Doesn't it make you sick? I paraphrase from a book I read in Foyles 'Since the arrival of the first tourists some years ago, theft, prostitution, rape and begging, previously almost unknown, have increased substantially " And I shall be staying in my 2½ star hotel, doubtless with swimming pool, African tribal cabaret and day-trip to a vulture reserve Outside the beggars will follow me onto the beach I shall spend the equivalent of days and days of their takings just on my health insurance. Doubtless too I shall get drunk and alternate between pious sorrow for the inequalities of the world, and a studied, cool indifference which I shall pretend is necessary for my survival.

Well. Perhaps it will change me Put my money (no let's hastily change that to *actions*) where my mouth is (It had bloody better I'm doing too many things these days that have to be justified in terms of 'experience' or of 'getting to know the enemy' I'm very good at such justifications Do you do it too?)

Anyway, the point is I was making connections over a few pints, thinking that the least important thing to a Gambian was a personal computer and other such profundities, when it occurred to me that it was a bit like Desert Island (Floppy) Discs. Here comes the presenter

'You are a rich Western piggie, marooned in a poor, remote West African state with only 20 duty-free Marlboro and three Finnish tourists for your comfort What eight computer programs would you take with you? (The beach, as you know is nearly pure silicon dioxide and you are handy at lashing together a solar-powered micro-computer)'

'Perhaps I can start by listing some of the programs that *won't* be packed next to the Dio-calm and anti-malaria tablets I think I can do without Lissajous figures, and indeed all curves of sin, cos and tan. Logarithms and exponentials will be more than boring All mathematical forms and functions will seem mere bagatelles The line between the sand and sea will provide enough stimulus, enough metaphor of dialectic change and constancy

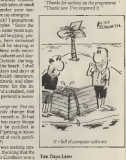
"So, too, all games of number, word or pattern, maze, spaceship, bats and bells I would quickly revert to drawing on the sand with sticks, and throwing those flat stones onto the sea No games

'Mortgages? No Nor wages, graphs, records, files, analyses, no money, time, predictions or performances

'Yes, yes, you're quite right That's not just narrowed it down that's virtually eliminated the entire program library Sorry about that I tell you what stop the tape!— I'll *go there*, make a series of well found observations, a little in depth research you understand, I'll take some notes remember some things Then when I come back, I'll tell you '

'Thanks for cocking up the programme '

"Thank *you* I've enjoyed it '


PETER DODSWORTH.

It's full of computer software

Ten Days Later

I hardly know where to begin.

The Gambia is a long, narrow country, completely enclosed by Senegal, except where the River Gambia emerges onto the

Discourse

coastline It is hot The people are extremely friendly One could not take three steps nor buy a drink, without meeting new friends small, medium sized and professional

Three of the local languages are Wolof, Fula and Mandinka Some speak English, a few French, but often one was reduced to machine-code a kind of binary

It was indeed a digital experience A sequence of yes's and no s to convoluted, imaginative, thirty-minute stories whose punchlines were always requests for money, addresses and so on Anything, everything seemed encodable into a series of exact (though usually wildly inaccurate) quantities A short distance was 'half a mile , anything further, 'eight miles A child spent a long time explaining that an old colonial fort had been built before 1972 , since that was when he had been born.

I sat at a table with a friend who was busy not-writing a manual for an IBM emulator for well that s a secret just as I was busy not writing a paper for a working party on the future of computers in design We drew lines of Julbrew lager (Gold Medal, Paris, 1979) to keep the mighty killer ants at bay (We had been trying to get them drunk, but they wouldn t touch it.)

We had seen a photo of the "King of Gambia This is a lion or rather the lion. There is one, sort of nationalised lion in The Gambia There are also supposed to be crocodiles — they have them on the 1 Dalasi coin. This coin, incidentally, is almost as rare as the crocodile it portrays — I had to pay 125 Bututs for one from a boy Well, he *said* they were rare

We both caught, and have imported into the UK, the dreaded Gambian Inside-Out Stomach Much of my aural impression of Banjul the capital, comes from the 48 hours I spent in bed, in a lightly fevered, gently sunburnt, slightly laxative — how shall I put it? a sort of terrified panic state — listening to the sounds of the street the docks, and the electricity generator outside the Adonis Hotel on Wellington Street

> *'What avocation, what mera repetition can capture the wild celebrations '*

What program can simulate that? What evocation what mere repetition can capture the wild celebrations when the first Snowflake Toilet Roll arrived made in the Peoples' Republic of China? How as we later sat on the white-hot rocks stuffed with Lomotil, Thalazole and kaolin and morphine, hallucinating on panaceas, could we possibly have used a personal computer?

Well, that is indeed the problem, the year's homework I have determined to conjure a multi- (well, more than one) media experience analogous to but going even beyond the horrific holiday slide shows of Mr Farmery when I was a kid, called 'My holiday in The Gambia'

It will consist of facts feelings, images, sounds and smells Temperatures will be raised The sun will shine, mosquitoes will bite Strong laxatives will be in the coffee

There will also be models of the Gambian economy the tourist influx, the historical and future role of that country and such countries There will be analyses of colonialism and stomach flora a small collection of souvenirs papers and tickets

The whole may be contained in a mock-up of an hotel bedroom It will contribute much to the state of computer simulation, art and the automatic diagnosis of certain stomach complaints

I am offering the prize of a Gambian coin to the value of 50 Bututs, with a picture of a horned beast on it, for the best suggestion of a BASIC program to run in this *ambience.* All entries to me at the RCA by April 1, 1980 Send nothing you d want back. And I strongly urge you all to go to The Gambia

(Oh yes, it did change me a bit, I think) ■

The Royal College of Art s address: Kensington Gore London SW7

DATRON of SHEFFIELD
for
Cromemco the ultimate name in micros

DATRON import direct from Cromemco, California.
DATRON can supply Nationwide.
DATRON can provide maintenance nationally.

DATRON can give you the realistic prices
DATRON have in stock –
System 2 64K £1995
System 3 64K £3292
Hard Disc £4998

DATRON can supply Systems 2 and 3 with Multi Tasking facilities (Hard Disc soon)
DATRON easily accessible – in the centre of the country.

Write or telephone for FREE colour brochure on System 3 or Z-2H
We use Cromemco for our own business,why not call in for a demonstration

CRA

DATRON MICRO CENTRE
DATRON INTERFORM LTD
Latham House, 243 London Road, Sheffield S2 4NF
Telephone 0742 – 585490 Telex 547151

XITAN SYSTEMS LTD

£4054.00 for the system with VDU CROMEMCO SYSTEM 3

The business system. System includes a full 64K fast RAM, dual full size floppies (Persci 277), RS232 interface/20mamp loop for console device, parallel printer port (Centronics/Anadex compatible) 21 slots for expansion Lear Siegler 24 lines at 80 chars vdu and

CROMEMCO's CDOS operating system with their 14 digit BCD extended disk Basic – ideal for those accurate large numbers required by successful businesses. CDOS is CP/M functionally equivalent with many extra facilities. Optional extras from Xitan include Fortran, Cobol, Text Formatting, Z80 macro-relocating assembler and DBMS at £58.00 each. CIS interactive screen handling Cobol at £425.00 *(recommended to serious business users).* Cromemco S100 boards. CP/M (we are an authorised oem distributor of Digital Research's CP/M) for the System 3, Wordmaster, Wordstar, Supersport and CPM374X utilities.

ON DEMO NOW! The Cromemco Z2-H

For **only £5380.00** get the reliability and quality of Cromemco coupled with the capacity of the new IMI 11 megabyte hard disk drive. This is incredible value for money. Specification includes transfer rates of up to 10 times faster than the fastest standard floppy disk, DMA controller for up to seven hard disk units, and the new extended CDOS operating system.

Systems available in three configurations: **(A)** The Z2-H complete integral system: 64K RAM, Z80A cpu, two double sided mini floppies, RS232 console port, parallel printer port, power supplies, cables, case and 12 slot S100 motherboard (7 slots free). **(B)** additional hard disk subsystem for existing system 2 and 3 users consisting of one hard disk, DMA controller, power supply, case and cable. **(C)** As unit B but with two hard disks. Prices: Unit (A) £5380.00 (B) £4330.00 (C) £7420.00

Xitan Systems also supplies and stocks vdus, printers, NORTH STAR HORIZON computers, Commodore Business Machines PETs, S100 boards and books. We are here to demonstrate the range of quality microcomputer systems available for use today. Ring up for an appointment now! You'll not be disappointed. We have Osborne's Sales Ledger and Payable Ledger in source form for use on Cromemco System 3 with CBASIC2 and we can offer a customising service on these programs. Additional software includes Microsoft Basic Interpreter and Compilers, Cbasic, Macro80 and CP/M for the North Star Horizon.

XITAN SYSTEMS LIMITED
23 Cumberland Place, Southampton SO1 2BB
Telephone (0703) 38740 *Hours Tuesday...Saturday 9.30am to 5.30pm*

CRA

BORIS DIPLOMAT

VOICE CHESS CHALLENGER

How strong are the new Chess Computers?

The [illegible] are now available in the range of portable chess computers. How strong are they? How fast? What depth of analysis can they provide?

COMPETENCE, The Chess Computer Specialists, in collaboration with some of the top chess clubs in the country has run in-depth *testing programs* on these machines (machine versus machine and machine versus player over all strengths). Before buying a machine send for this new information report (£1) which includes full test results and comparative strengths and features of all machines on the market.

Please send me
☐ your comparative report (I enclose £1)
☐ details of your different chess computers

NAME ______________________

ADDRESS ______________________

____

____

____

TELEPHONE NUMBER

DATE

Please fill in the form above and send it to COMPETENCE, Dept CA
56 Clarendon Road, London W11
(Tel. 01 229 8275 9am–noon Mon–Fri)

THE 1980's PRINTERS

DOLPHIN BD 80 PET COMPATIBLE

- CHOICE OF SERIAL PARALLEL OR IEEE INTERFACE
- 112 CHARACTERS SECOND
- 80 OR 132 CHARACTERS LINE
- PET GRAPHICS
- 800 CHARACTER BUFFER
- MICRO PROCESSOR CONTROLLED
- BI-DIRECTIONAL PRINTING

GREAT VALUE £525 + VAT

COBRA BD 136 £1195 + VAT

FAST [illegible] HIGH QUALITY [illegible] MICROPROCESSOR CONTROLLED

- [illegible] CHARACTERS SECOND
- 136 CHARACTERS LINE
- [illegible] CHARACTERS BUFFER
- SERIAL PARALLEL INTERFACE
- [illegible] DOT MATRIX
- BI-DIRECTIONAL PRINTING

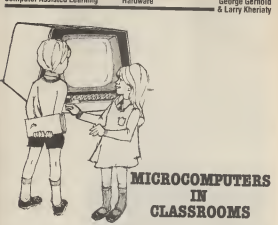
This must be the lowest cost, best value, highest performance printer on the market

Get the hard copy facts from us

Vector
Computer Systems

47 Oxford Street
Southampton
SO1 1DP
Telephone
Southampton
(0703) 39891
(24 Hours)

George Gerhold & Larry Kheriaty



MICROCOMPUTERS IN CLASSROOMS

In this second article the authors consider the hardware requirements for CAL, or CAI (Computer Assisted Instruction) as it is known in the United States. The first article dealing with the optimum features of a CAL language appeared in Issue 3 (February). The next article to appear in Issue 5 will be an introduction to COMMON PILOT *their co-written version of* PILOT

The classroom computer should provide for three types of application: computer-assisted learning, traditional computing and text editing. In the current marketplace any piece of hardware which can be used for CAI and text editing will be adequate for the level of traditional computing needed in the classroom so we will concentrate on the hardware features needed for CAI and text editing.

The most critical component in both these applications is the terminal, so we begin our discussion there. The advantages of the CRT terminal over the printing or hardcopy terminal for these applications are overwhelming. Hardcopy terminals are too noisy for the classroom, they are less reliable, they require expensive paper, they are slower and they preclude using graphics or doing any real text editing.

'Lower case is essential'

But hardcopy terminals do offer one undeniable attraction: they provide a permanent record of the interaction. We suspect that the desire for a printed copy of programs and for user runs is based on a habit which can be broken with sufficient exposure to a text editor of high quality and speed, but since we have not yet broken that habit ourselves we cannot expect others to do so quickly. In our campus installation we find that a mix of three CRT terminals to each hardcopy terminal is about right. For smaller installations we think that the need for graphic display is so great that we recommend using CRT terminals exclusively, and we will proceed on that assumption.

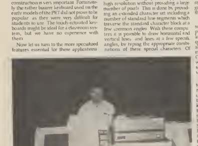
Let us divide our discussion of the characteristics of the ideal CRT terminal for these applications into three parts: characteristics of all CRT terminals, features necessary for these applications, and features which may be useful for these applications in special situations or in the future. The CRT terminal should display at least 24 lines of 80 character length. We do not mean to imply that it is good programming practice to fill the screen with some 1900 characters at one time but, especially in CAI, one often wants to refer the user back or use empty space on the screen to format material or emphasize particular points. Programming without hardcopy is much easier when the window on your program is large. We find it much easier to make do with screens that hold less than 24 lines than to adjust to screens where the line length is less than 80.

Lower case is essential for both of the critical applications. There is a strange tendency for computer users to always use upper case, even when there are no hardware or software reasons for doing so. Teachers are understandably put off by the idea of exposing their students to another notation system, even if that system is just all upper case. The necessity of lower case for text editing is too obvious to discuss. Although most terminals now offer lower case, the quality of the print is very poor in some models. Descenders should descend, and numbers should not look like letters. Remember that the student may some day be spending extended periods of time reading what is on the screen, so sharpness and legibility are important. An important detractor from legibility is screen glare due to room lighting. Our preference is for terminals which use 8 x 12 dot matrices for individual characters and screen phosphors for immunity to glare.

Many terminals offer features which offer no particular advantage for these applications, for example, a numeric keypad. If those extra keys can be redefined for other purposes, that is useful. The classroom terminal may have to endure physical punishment (often due more to uncontrolled enthusiasm than malice) so quality of construction is very important. Fortunately the rather bizarre keyboard used on the early models of the PET did not prove to be popular, as they were very difficult for students to use. The touch-activated keyboards might be ideal for a classroom system, but we have no experience with them.

Now let us turn to the more specialized features essential for these applications.

Hardware



Professor [illegible] at one of the terminals of a micro-based multiuser system (SWTPC109) at Western Washington University.

Graphics are essential. Graphic resolution is specified by the number of individual pixels (picture elements) in the horizontal and vertical dimensions which can be individually addressed. A standard CRT terminal without graphics has a graphic resolution of 24 x 80 pixels, that is each character position can be individually turned on (although the only way of addressing that position may be by typing spaces across the line). The PLATO system terminals offer the best graphics in use for CAI; they have a resolution of 512 x 512 pixels.

Of course, resolution costs money, in part for the memory to keep track of what pixels should be turned on, so many users settle for less. At the very minimum the programmer or author should be able to use least 10 000 pixels on the screen. Unfortunately, only a few of the more expensive terminals give the same distance between pixels in the horizontal and vertical directions. Thus in most cases a square of pixels turns out to be a rectangle when displayed. In the corners of a curved screen with typical CRT pincushioning, the problem is even worse.

A number of the lower-cost computers are able to generate graphics of apparently high resolution without providing a large number of pixels. This is done by providing an extended character set including a number of standard line segments which traverse the standard character block at a few common angles. With these computers it is possible to draw horizontal and vertical lines, and lines at a few specific angles, by typing the appropriate combinations of these special characters. Of course, there is no way to draw lines at other than these few angles. The closest approach is a discontinuous series of segments. While this is probably preferable to no graphics at all, for many applications such graphics will be useless.

Graphic displays are usually generated by drawing a series of vectors, or in some of the more elaborate terminals as a series of vectors and arcs. Current technology seems to favour inclusion of the microprocessor within the terminal, so it is possible to assign the terminal the task of generating the vectors, etc., from coordinates transmitted from the CPU. This is preferable because it reduces the load on the CPU, makes the graphics easier to implement in a variety of languages, and does not tie up a large segment of the main memory with pixel storage.

A number of factors favour the adoption of multi user systems for classroom use. In our opinion, multi user systems should have all hardware dependent display functions including graphic generation assigned to the terminals, for only in this way will it be possible to use a variety of terminals on one system. We must admit that systems which display a map of the main memory directly offer a speed advantage which could be important in CAI applications where animation is to be used. The ideal combination appears to be a system which transfers preprocessed graphic display information directly from the disc into the terminal memory.

It must be possible to do a variety of selective erases within the graphic display. It should be possible to erase points, lines, and large sections of the screen quickly. The processor within the terminal should provide, at a minimum, erase to end of line and erase to end of screen. Obviously this must be accompanied by a way to move the cursor to any point on the screen directly, without erasing the intervening display.

While it is not too unusual to find a terminal which allows the computer to move the cursor around the screen efficiently, very few terminals allow the user the same freedom. Cursor controls at the keyboard are too slow. The obvious solution is a light pen. Unfortunately, there seem to be serious problems with reliability, especially in classroom installation. Students seem to have serious difficulty limiting light pens to the uses for which they were intended. Light pens do not take well to double duty as toothpicks and ear cleaners!

Again, the PLATO terminal seems to provide the best solution, the *touch panel*. The screen is surrounded by an array of infrared lights and detectors. By pointing at the screen the user interrupts a crossed pair of beams, and this is sensed as a screen position by the terminal for transmission back to the computer. The PLATO terminal is too expensive for most classrooms, but not because of the touch panel. We know of no reason why the touch panel could not be added to a variety of more reasonably priced CRT terminals. The PLATO terminals are available with touch panel resolutions of 16 x 16 and 32 x 32, either of which seems sufficient.

The PLATO terminals offer another feature of very great utility in CAI applications, a user defined character set. There appears to be no reason why this could not be a common feature in terminals, and its utility in many applications is obvious. Foreign languages, mathematics, and computer languages like APL are obvious applications

Perhaps the most widely demonstrated CAI program is based on the ability to define alternate character sets on the PLATO terminal In a genetics teaching unit on the breeding of fruit flies the various body parts of the flies are defined as new characters In this way it is possible to draw out a new fly by transmitting a few characters instead of by a very elaborate graphics routine for each new fly The potential usefulness of this capability to define character sets is so great that the first terminal supplier to offer this feature at a reasonable price may well sweep the educational market

Any terminal which offers the features mentioned thus far will be excellent for CAI, but one might want a few additional features for text editing Obvious examples include a variety of scrolling and form feed features Almost every terminal will scroll forward but not all terminals will also scroll backward While insert and delete functions can be provided by software in the CPU, the response will be much faster if these are also terminal functions

Let us now turn to features which are for more specialized CAI applications For many purposes it would be convenient to have sound output In the simplest applications this might be a simple tone generator The latest crop of electronic games gives indication of how effective such output can be Music instruction demands generation of at least four simultaneous tones, preferably with varying duration intensity and timbre The ultimate capability of this type is true phonetic speech generation Both multiple tone generation and speech generation are available for microcomputers as separate boards but thus far no one has incorporated them into the terminal — where they belong

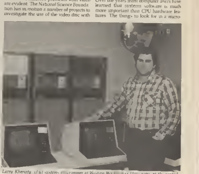
The graphics we have discussed up to this point are simply one colour line drawings The better CRT terminals offer dual intensity display and a number of the personal computers offer colour We group these two features together because we think that they are useful for the same purpose, to emphasize selected portions of the screen display Reverse video or flashing could be used for the same purpose Some feature of this type is essential Often the author provides an explanation and asks a related question the answer to which indicates that the student has missed some portion of the explanation One way of handling this is to emphasize the relevant portion of the display by changing colour intensity reversing, etc Colour displays have many uses for example, complex graphs can be clarified by using several colours

However our opinion is that colour is overused and of limited utility perhaps even distracting and tiring in CAI applications Part of the problem is the poor quality of most colour displays If colour monitors were available which allowed text to be displayed as sharp letters without colour fringes then we would be inclined to

Hardware

include colour on our list of essentials

Some users need graphics beyond the level of line drawings Medical applications or courses in art history require full colour pictures A number of groups have succeeded in interfacing some type of projector with a terminal but none of these systems has approached commercial viability It now appears that the solution will be the video disc although the resultion and colour accuracy problems with video are evident The National Science Foundation has in motion a number of projects to investigate the use of the video disc with



Larry Kheriaty [illegible] systems programmer at Western Washington University at the control terminals of the minicomputer based terminal system Each of the computers in the background (Interdata Perkin Elmer 7432) drives 24 terminals

microcomputers for CAI. The great advantage of the video disc is its capacity one disc will hold 54 000 slides Thus it should be possible to put a library of slides onto a disc and then to allow any number of authors to write a variety of courses which access this library Unfortunately the current projects are working towards inscribing the programs as well as the pictures on the disc thus precluding any editing or revision of the programs

Two additional input devices may be useful in some applications The MICKEY project is an attempt to computerize the taking and recording of a portion of the medical histories of new patients The typical keyboard is thought to be too complex for this purpose, so a four button input device (for this application marked yes, no don t know and don t understand) was built Such devices may be useful for very young children as well Input of complex graphics is quite difficult and time consuming, if the input consists of sets of grid coordinates A bit pad which allows the results of tracing or drawing of figures to be fed directly into the computer can be a great help in this case Obviously the bit pad input requires that some type of graphics editor which can communicate with other high level programs be available for processing such input

Although it may be difficult to select a terminal which has the features you want, it should be no problem to select a microcomputer to drive that terminal

There is a great variety of microcomputers on the market but the differences between them are not of much importance Over the years most computer users have learned that systems software is much more important than CPU hardware features The things to look for in a microcomputer for a school are reliability, service availability and cost While our experience in the United States may be of limited relevance in Europe, we have found that there are very significant differences in reliability, and we have found that the growth of the personal computer market has brought many people into sales and service of microcomputers who are not sufficiently prepared The result is that most local service turns out to be an illusion so that one should count on factory service from the start

The classroom computer does not need to be an all-purpose computer The student enthusiasm for the computer is likely to create such demand for use of the standard application packages that no time will be available for other uses Thus some of the highly advertised features of some microcomputers are not of great value in a classroom computer Examples are standard bus structures and standard versions of languages Standard bus structures are

Hardware

valuable when a variety of additional special application boards are to be used, but in the classroom the special features needed are primarily I/O features which should be assigned to the terminal.

Although standardization of languages is desirable the advent of the microcomputer has made it rather less important in the classroom setting If I have a package of instructional material which you want to use, and if that package is of any real size, then you will have to purchase additional hardware to deliver that additional service to the students Given that you have to purchase additional hardware, it is not of vital importance that the new hardware use the same language versions that you already have That is a large, high-quality CAI package will completely occupy the new hardware so it is not of great importance what else that new hardware could or could not run

The remaining major hardware component is the large storage device Obviously, the cheapest device is the tape recorder but we find that completely inadequate for classroom use Instructional programs are very long programs by conventional standards The small demonstration programs we supply with the COMMON PILOT interpreter occupy about 25K, we are currently working on a package of grammar programs which will occupy close to a megabyte Although such programs can be segmented to some degree, there are limits imposed by that procedure The amount of memory must be large so that the segments can be of reasonable size. (We find that five minutes of instructional dialogue occupies about 8K.) Unfortunately tape is slow and the instructional strategy may allow the well-prepared student to skip ahead 16 32K In many cases the load time is intolerable

However there is an even more serious drawback to tape The branching structure of instructional programs is very complex, and a tape-based system can only branch easily to those sections of the program resident in memory Practically speaking, it is impossible to branch backward to a section no longer in memory

'Colour is overused and of limited utility'

With a disc, all these problems disappear The other advantages of discs are so well known that we will not list them here The only important features of the discs for this purpose are compatibility with the systems you plan to use and reliability If you want to keep records and statistics of the use of the programs you should make sure that random access files are supported

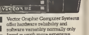
Our comments about the microcomputer and the disc features have been somewhat negated by the release of the new generation of microprocessors These new microprocessors (e g The Motorola 6809 and the Intel 8086) have the capability of driving multiple terminal systems Multiple terminal systems are attractive for the classroom for a number of reasons The cost is an obvious one the cost of a four terminal system is about double the cost of a single terminal system The typical mix of classroom activities does not make heavy demands on the CPU, so the response time on a multiple-user system is still quite acceptable (Remember that we have assigned many of the more time-consuming tasks like graphics and sound generation to the terminals) Maintenance of programs on the discs is simplified by at least a factor of the number of terminals with a multi terminal system Finally, on those rare occasions when the students are not demanding access to the system the larger system implied by a multi terminal setup can be used for other tasks in a single user mode

We come then, to a summary of our analysis in the form of a recommendation.

Even if we only could foresee a single terminal in the classroom, we would purchase a microcomputer which could be used as the core of a multi user system If possible we would purchase an 8" disc for the same reason, but a smaller disc will function in multi user mode Finally we would get as many of the listed features as possible in the terminal but we would insist on upper and lower case and on some form of graphics

We would then immediately begin pointing out to the budget authority what an increase in service they could get, at what an incredibly low cost, by simply adding terminals to this system ■

To be continued



A
PROVEN
COST EFFECTIVE
PROBLEM
SOLVER

Vector Graphic Computer Systems offer hardware reliability and software versatility normally only found in much more expensive equipment.

Standard systems include over 600K of on line storage, 56K Ram, multiple I/o facilities with options of integrated terminals and various operating systems.

Prices start under £3,000
Languages include. Fortran, Cobol, A.P L., Pascal and others.

Almarc offer professional hardware and software support combined with competitive prices.

ALMARC
DATA SYSTEMS LTD
906 Woodborough Road,
Nottingham. Tel (0602) 625035.

Darrel Ince

WRITE IT YOURSELF

Part II

Continuing the series, the first article of which appeared in issue three. Dr Ince is at the Faculty of Mathematics, the Open University, Milton Keynes.

I have described in the previous article of this series how an assembler can be split up into two passes. The purpose of this article is to describe the first pass in some detail. The algorithms that I shall present are fairly general; they can however be modified to handle specific assembler languages. The pass 1 algorithm can be described as

See fig 1

```
while we [illegible] the assembler program do
  begin
  Read a line of assembler program,
  If the line [illegible] comment then
    begin
    If there is a label on the line then enter it in the symbol table
    Look for the operation name in the op[illegible] table
    If the operation name [illegible] found in the table then
      begin
      Look for the operation name in the pseudo operation table
      If it is still [illegible] found then [illegible] error as [illegible]
      else process the pseudo operation
      end
    else [illegible] when the instruction is to be placed
    end
  end
```

Fig 1

A Pascal version of the above algorithm is shown below; it differs slightly from the above in that the error handling concerned with the discovery of duplicate labels is included.

See fig 2

```
type symbol    = array [1..[illegible]] of char
     operation = array [1..[illegible]] of char
var  slabel : symbol; operation name : operation
     index, address, line number : integer
     found, comment, ok, prog end : boolean
(* pass 1 of assembler *)
begin
address = 0; prog end = false; line number = 0; Initialise[illegible]
(* assembler source is taken from the file input *)
reset (input);
While not prog end do
  begin
  read a line; line number = line number+1
  If not comment then
    begin
    (* If there is a label enter it in symbol table *)
    If slabel <> '         ' then enter (slabel,address, ok)
    (* check if duplicate label has been found *)
    If not ok then notify error (line number, duplicate label)
    (* look for the instruction name in the operation table *)
    search opcode table (operation name, index, found)
    If not found then
      begin
      (* operation was not found in operation table *)
      (* try the pseudo operation table            *)
      search pseudo op table (operation name, index, found)
      (* if operation not found then error         *)
      If not found then notify error (line number, unrecognised operation)
      else process pseudo op (index)
      end
    else (* increment address counter *)
      address = address + opcodetable [index] length
    end
  end
end (* of pass 1 *)
```

Fig 2

This Pascal version of pass 1 uses a number of procedures; the largest of these is the procedure read a line. This reads a line of assembler program; it then sets a variable called comment to be true if the line is a comment. If the line is not a comment then the procedure assumes that it has read an assembler instruction; it then extracts the operation part of the instruction and places it in the variable called operation name. The procedure then examines the line for a label; if one exists it is placed in the variable called slabel.

See fig 3

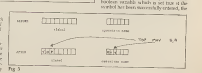


Fig 3

If the instruction does not contain a label then the variable slabel is set to contain spaces. I shall not present Pascal code for this procedure as it really depends on the assembler language being processed; happily the coding for this procedure, although fairly laborious, is quite straightforward to write.

The second procedure that is used is called enter. It has three parameters: the first parameter is the symbol that is to be entered into the symbol table, the second parameter is the address at which the symbol is located and the third parameter is a boolean variable which is set true if the symbol has been successfully entered, the boolean variable is set false if the symbol has previously been entered in the symbol table This procedure can be written as

See fig 4

The algorithm for enter assumes the symbol table has been initialised to contain blank entries this is carried out by the procedure called initialise which is executed before any assembler statements are processed by pass 1 The symbol table formed by the procedure enter is to be searched in pass 2 thus searching process can be made more efficient if the entries in the table are ordered alphabetically This ordering is not carried out by the procedure enter I have purposely used a simple algorithm as it is a good principle that in constructing a program you do things simply at first It may lead to inefficiency but it will mean that your program will be working fairly quickly, at this point you can eliminate any inefficiencies It is always

better to have an inefficient program that works rather than an efficient program which takes months to get correct

The next two procedures used by pass 1 are search pseudo op table and search opcode table They involve the process of searching the operation table and pseudo operation table looking for an operation name If the operation name which is the first parameter has been found then it sets the third parameter true and places the position of the operation in the table into the second parameter These procedures are very similar so I shall only describe search opcode table

See fig 4a

The reason why the operation table is searched is to enable the pass 1 algorithm to calculate the address where the next instruction is to be placed Thus if pass 1 had just examined the instruction

ADD M

the operation name ADD is searched for in the operation table, If it is found let us assume that its position is placed in the variable called index, then all the algorithm has to do to calculate the address at which the next instruction starts is to execute the statement

See fig 4b

The reason why the pseudo operation table is searched is because certain pseudo operations affect the address at which the next instruction is placed, e g If the current address at which an instruction is placed is 32 and pass 1 encounters an instance of the pseudo operation DB

```
DB 0
   1
   2
```

then the next instruction must be placed at address 35, this is because the pseudo operation DB (Deposit Byte) allocates three bytes for the three pieces of data 0, 1 and 2

The procedure process pseudo op has one parameter which represents the position in the pseudo operation table of the pseudo operation that is being processed If the pseudo operation table is stored as

DB
DS
END

Then the procedure process pseudo op will have the form

See fig 5

It will consist of calls on procedures that handle the various pseudo operations An example of one of these procedures is process db which would read the 8-bit data defined by DB and would adjust the value of the variable called address accordingly Mention must also be made of the procedure which handles the pseudo operation which marks the physical end of the program being assembled in the fragment above this would be the procedure process end This procedure would set the boolean variable prog end to true, thus terminating pass 1 The only part of this pass that I have not dealt with is that concerned with the handling of errors, this I will describe in more detail in the next article of the series What I will say at this stage is that the user of the assembler must be given as much information as possible about the type of error and where it occurs in his program, this is the function of the procedure called notify error

This then is the outline of pass 1, my next article will deal with pass 2 which uses the tables built up by pass 1 in order to accomplish the assembly process ■

```
procedure enter (symbol entered : symbol ; symbol address : integer ;
                 var successful : boolean);
(* Enters a symbol into the symbol table. If the symbol already       *)
(* exists in the table then it is not entered and successful is set   *)
(* to false  I have assumed the table contains a maximum 500 entries  *)
var j : integer; loopend : boolean;
begin
j := 1; loopend := false; successful := false;
while (j <= 500) and not loopend do
   begin
   (* check if symbol is already in table *)
   if symbol table [j] name = symbol entered
      then loopend := true;

   (* check for blank entry *)
   if symbol table [j] name = '          ' then
      begin
      loopend := true; successful := true;
      (* enter the symbol into the symbol table *)
      symbol table [j] name := symbol entered;
      symbol table [j] address := symbol address
      end;
   j := j+1
   end
end; (* of enter *)
```

Fig 4

```
procedure search opcode table (op name : operation; var position : integer;
                               var successful : boolean);
var i : integer; found : boolean;
begin
i := 0; found := false;
while (i < 100) and not found do
   begin
   i := i+1;
   (* found is set true if search is successful *)
   found := opcodetable (i) name = op name
   end;
position := i; successful := found
end; (* of search opcode table *)
```

Fig 4a

```
address := address + opcodetable (index) length
```

Fig. 4b

```
procedure process pseudo op (position : integer);
begin
case position of
1 : process db;
2 : process ds;
3 : process end

   :

end;
```

Fig 5

THE MICROCOMPUTER AND THE TEACHER

Historians may well look back on this decade as the age of the microprocessor Local Education Authorities throughout the country are purchasing microcomputers for use in schools and colleges of further education, realising that in a few years time microcomputers like pocket calculators will be commonplace and computer appreciation may well be part of the core curriculum of every school

It is clear that we, as a nation have an overriding need to compete in international markets increasingly dominated by economies that are both advanced technologically and responsive to change The realities of life dictate competition by an economy composed largely of outmoded equipment and methods with minimal new investment in either It is obvious from this that, at the secondary level the ablest pupils at least *consider* engineering and management as careers that can and do offer real challenges to the best minds Unfortunately, engineering with its images of dirt pollution and greasy overalls, and management seen as a combination of pushing paper, business lunches heart attacks and cowering before unions, do not produce the correct incentives If pupils are to consider engineering or management as a career then they *must* feel some sense of involvement, through suitable activity, with the sort of problems that have daily to be solved in industry

Clearly the problems presented to the pupils must fall within three criteria. They must –

- 1) fairly reflect the range and type of problems they would meet in industry
- 2) be within the scope of the school in terms of equipment and supervisory experience
- 3) be able to be implemented without major curriculum changes

It is in the first area, in the context of problem solving, that microcomputers may well provide the catalytic action required

Secondery schools

Since about 1968 some 1200 secondary schools in the UK, i.e about 25% have gained access to computing facilities either by the purchase of a microcomputer or by teletype — telephone line connection to a mainframe machine housed in a local university or polytechnic I would anticipate that by 1985 approximately 50% of secondary schools will have computing facilities of some sort most probebly micros I base this figure on three factors

- 1) The falling real cost of microcomputers
- 2) The decreasing use of terminals due to higher costs of installation and telephone line rental
- 3) The increasing awareness amongst local education authorities of the value of a school- or college based microcomputer system

Taking these points in reverse order, in the pest year or so the L E A 's of Inner London Bucks Herts, Birmingham Avon and Sheffield have committed themselves to the purchase of a particular micro-system Others are evaluating several systems with a view to the adoption of one

Considering the second point many establishments which offered computing time via teletypes to local schools now find that their own commitments are so pressing that their systems are at the point of overloading Thus may result in an unacceptable delay time between one particular external user and the host machine

To take the first point as more microcomputers appear on the market and some are produced in larger quantities then prices should fall e g the Commodore PET has recently fallen in price to £550 and the NASCOM kit to about £170

Broadly speaking the current uses of microcomputers in schools fall into two main curriculum areas

- 1) Computers for their own sake (computer studies to C S E or O' level or computer appreciation non examination courses)
- 2) Using computers as a teaching aid in such subjects as maths, physics, chemistry biology, economics and geography

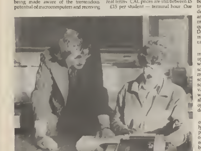
In the second category much work has been done to produce CAL (Computer Assisted Learning) units by a) the Schools' Council with their Computers in the Curriculum project b) The Chelsea Science Simulations c) The Warwick Science Simulations

What exactly is CAL? It may be defined as the interaction between a student and a computer backed up by suitable software of three classes (instruction revelation simulation) Much of the initial work was carried out in the USA although Britain contributed significantly with a five year programme ending in 1977 Perhaps the future may be bright with £12M over the next five years earmarked by the Department of Education for schools computing What is required is the DES to make it quite clear how the money is to be allocat-

[illegible] using all the money for purchase of computers if no teachers are to be trained to use them.

Richard Hooper, the director of the recent CAL programme, and now MD of Mills & Allen Communications, summed up as follows: "The major benefits to come from investment in CAL are likely to be qualitative in nature — teaching new topics that could not be taught with existing methods, assisting in the teaching of 'high order' skills such as decision making and problem solving, and improving the quality of existing teaching by tailoring it more sensitively to the individual needs of the active student."

The recently formed MUSE (Microcomputer Users in Secondary Education) has a rapidly growing library of programmes, suitable for running on the Research Machines Ltd 380Z. Most of these programmes are maths or science based, although efforts are being made to encourage teachers of other subjects to contribute. In fact, as a result of more teachers being made aware of the tremendous potential of microcomputers and receiving some training in programming, I would expect to see more software written for such subjects as English Language, French, German and History. For example, some aspects of language studies may be regarded as a sub-set of word and text processing. In this context, there is a great deal of software written for word processing. In its simplest form a language programme to correct grammatical errors would consist of a phrase marker as well as including some rules of syntax (correct word order) and semantics. Translation however is more difficult, in that, although the rules of syntax may be written into the software, semantics does not categorise so easily.



Dr. Bob Cooke and pupil with an AIM65. The school also has an ITT 2020 microcomputer.

Teacher's View

Although multiple choice type question and answer programmes could be written with very little effort this can hardly be described as inspiring to the student. Programmes with a great deal more originality need writing, probably by teachers with subject and software expertise. The programmes generally would need to have more of an interactive element than the multiple choice programme, in order that the output via a visual display unit is more stimulating to the student. This in fact is true of any CAL unit, and why stimulating software is the most crucial and expensive part of CAL.

A teaching programme lasting one hour may take several hundreds of hours to prepare by professional programmers who can command high salaries. Even though microcomputer costs are falling in real terms, CAL prices are still between £5-£15 per student — terminal hour. One obvious solution here is to make extensive use of the microcomputer user clubs and of teachers who have been trained in effective programming techniques (the national CAL programme costed teachers' time at — between 60p and £2.50 per hour).

One feature of computer usage generally is the ability to simulate experiments which normally could not be carried out in a school laboratory due to lack of equipment, space or safety reasons.

Some examples of these are programmes which are available to simulate a mass spectrometer, thermal runaway in nuclear reactor, enzyme kinetics, competition between species in a pond ecology and the contact process for manufacture of sulphuric acid. All of these programmes make use of the microcomputer's graphics capability, which is far more stimulating than just looking at lists of figures on their own, although output in the form of words and numbers does play an important part.

One other important feature is computer-based modelling. With a microcomputer system the interaction between student and machine is instantaneous and the machine is performing the often laborious calculations. The 'What if ...' situations are those for which computer modelling is ideal. Economic models are an example of this and students can run these to model the country's economy for a few years and see the effects of different budgets. Perhaps this ought to be compulsory for potential Chancellors of the Exchequer. I can imagine that variations on this type of modelling may be used in history, using census returns and other subjects where an end result is due to the influence of many variables, some or all of which may be altered. Consider for example alternative history — what if Charles Martel was defeated at the Battle of Tours by the armies of the Prophet Mohammed. Islam may have resolved its difficulties and conquered Europe. There would have been no Dark Ages and the Industrial Revolution may have started several hundred years earlier.

There are exciting possibilities too in remedial education which is often looked upon as a poor relation in schools. With widespread use of microcomputers in schools I can visualise a time when remedial problem children spend at least some time with a micro, being guided via software through a choice of lessons of varying degrees of difficulty. Much software development is needed in this area although the 'Smalltalk' language developed in the USA appears to offer a great deal of promise and pupil interaction.

Turning now to 'computers for their own sake', computer studies or more likely computer appreciation may well form part of a school's core curriculum in view of the impact that computers will have on education generally. The argument has been advanced that television plays an important part in education, but I believe this to be false reasoning. Television has not, to a large extent, affected many people's working lives although it may have altered their social habits somewhat, but microcomputers and microprocessors will greatly affect almost everyone's working life. As far as the more able pupils are concerned 'O' and 'A' level computer studies courses already exist, as does an 'A' level Electronic Systems run by the AEB. Future revisions of this later syllabus should include applications of the microprocessor other than per se microcomputer usage — for example, the interfacing of microprocessors to perform timing and control functions. One example of the former is the way in which a microcomputer may be used to produce music.

In addition I believe there should be room in the curriculum to develop general 'thinking' skills generally associated with [illegible] flowcharting, problem [illegible] and keyboard practice. The [illegible] whenever any problem [illegible] broken down into a series of [illegible] and will be as at least [illegible] decade as the more tradi[illegible] and numeracy.

One problem beginning to face teachers [illegible] all secondary schools now is that [illegible]. The whole role of the school [illegible] to be redefined in future curriculum development. One possibility is a much stronger link between schools and the outside world whereby subjects are offered to shift workers with free time to housewives or the elderly on a 'drop in and learn' basis. The traditional classroom approach would obviously be of no use here as groups would vary in size, ability, motivation and subject interest. But using a micro computer with multiple terminal access would enable each user to select one or a group of subjects of specific difficulty whilst the teacher would act in a tutorial capacity.

An alternative to this, already being tried in some European countries, is that of paid educational leave whereby workers receive about two weeks per year of in service training to upgrade their knowledge, or a longer period of time to receive retraining for new jobs. Since industry would be more directly involved, perhaps some funding by industry may be possible. The obvious question we must ask, however, is how could the money be generated for such funding? Ironic as it may seem, the answer may lie in the microprocessor itself. With greater use of microprocessors in industry, greater productivity should result. However, one effect of using microprocessors on a large scale will be a reduction in manning levels in some industries, which will require staff to be retrained. Some of the extra money generated as a result of hopefully increased productivity could then purchase microcomputers to be employed in that retraining.

'How could the money be generated for such funding?'

There are some teachers who are understandably reluctant to commit themselves to the microcomputer, having had experience of other supposedly revolutionary aids, such as teaching machines, which were supposed to relegate the teacher's role to that of supervisor. I believe, however, that we are in an entirely different situation.

Microcomputers available today will not be outmoded in a few years time as were teaching machines. In fact a well designed microcomputer system of today anticipates future expansion [illegible]. Anyone reading the technical press in the late 1960's or early 1970's would have heard of the microprocessor and may have projected its use into education. Reading the same journals today I cannot foresee any radical new device which will render obsolete the micros of today. True, memory will become more densely packed with widespread use of the 64K chip and magnetic bubble memories, and perhaps the 16-bit microporocessor will become the standard as no doubt will colour graphics, but no completely new device is on the horizon. Education is about communicating techniques and the microcomputer can be a powerful ally in this respect. To quote a certain TV series, "We have the technology", what we *do* need are a sufficient number of teachers in all disciplines to acquaint themselves with the full potential of that technology and to develop curricula accordingly. The real difficulties surrounding CAL are not technical. What requires attention and vigilance are the political and educational environments.

We do not have robot teacher replacements nor wish to have them, but teachers who do not appreciate the extent that they will soon be involved in CAL programmes have their heads in the sand. That may be a good place to find the raw material for silicon chips, but it is no way for teachers to plan to meet the educational needs of the 1980's. ■

Dr Bob Cooke teaches advanced physics and computer studies at Newfield School, Sheffield

MICRO MANAGEMENT

APPROVED DEALER

APPLE II PLUS

We are professional businessmen with combined Management, Accounting and Computing knowledge covering many diverse commercial environments.
You will not be met by HARD salesmen, but a team ready to assist, advise and answer any questions you may have. Every business is different and we will endeavour to suit your individual requirements.

APPLE II Plus is usually programmed in BASIC but now has available for the first time PASCAL, probably the most exciting new computer language around.

OUR STANDARD SOFTWARE
- SALES LEDGER
- PURCHASE LEDGER
- NORMINAL LEDGER
- WORD PROCESING
- ASSET REGISTER
- APPLICATION SOFTWARE - LEISURE, INSURANCE, VEHICLE HIRE, TRANSPORT

PLUS MANY OTHERS

Quick installation, On-Site instruction and personal attention is our guarantee of your satisfaction

Micro Management,
13-15 Connaught Avenue,
Frinton-on-Sea,
Essex Tel 02556-4592

Peter Krass

COMPUTER RETAILING, TRISECTED

The exclusive letter from America will be a regular feature in Computer Age *by arrangement with Technology [illegible] of America, publishers of* Computer and Communications Buyer, *the market ne[illegible]*

> 'These customers neither like nor dislike computers.'

Small computer retailing is coming of age. There are now basically three different markets: this has led to the emergence of three different types of computer stores in the United States. A similar maturation can be expected in other countries as well.

The first type of retailer is the merchandising store, where the computer is treated as a commodity. These merchandisers sell computer systems at very low prices to individuals and to small businesses.

The second type of retailer is the hobby store, where computer systems are sold to knowledgeable enthusiasts. Unusual software applications are often given the main spotlight. In addition, these stores provide a place for computer hobbyists to meet and keep abreast of new ideas.

Third are those stores operated by large computer vendors, where word- and data-processing systems are sold primarily to small businesses. These stores also attempt to educate the potential customer on the benefits of owning a computer.

Tandy's Radio Shack is perhaps the best example of the first type of store, the merchandiser. Computers at Radio Shack are sold side-by-side with stereos, ham radios and other electronic products. The merchandiser sells computer systems to individuals and businesses willing to take some risk on a low-cost product with little vendor support.

In terms of sales volume, Radio Shack's success has been impressive. With some 7000 outlets across the US, the retailer has sold approximately 200 000 computer systems since it began selling them about 2½ years ago. A large part of this success is unquestionably due to the very low price of the retailer's computers. Its TRS 80 Model 1, for example, sells for about $500. This is simply the lowest priced system available anywhere.

In addition, Radio Shack is trying to take the mystery out of computers. The Model 1 has been advertised as an educational device for children and a suitable Christmas gift for the family. The merchandiser touts the computer as something akin to a chemistry set: a scientific toy involving the participant in an activity requiring far more creativity than, say, watching television.

Merchandisers are also advertising computers for the household. Here, the computer is shown as a household appliance, just as useful, and certainly no more intimidating, as other technologically sophisticated devices in the home. Home owners are told that they can use a small computer to manage their home finances, catalogue recipes or help the kids with their homework.

Significantly, Radio Shack, along with some of the other merchandisers, is also marketing computer systems for commercial use. Radio Shack's Model 2 line is advertised as "low-cost computing for the masses," especially useful for the small business.

The second type of retailer, the hobby store, is often run by computer hobbyists for computer hobbyists. These stores cater to the sophisticated user, and the atmosphere is similar to that of a high quality hi fi or camera shop. Customers do not need to be instructed on the basics; instead, they want to keep up with new ideas and developments. When they come to buy, they generally know what they want.

These stores are not geared to the beginner: the atmosphere can be intimidating to anyone other than die-hard hobbyists. The hobby market, however, is slow growing. It is therefore likely that many hobby stores will try to reach out to the curious beginner in order to boost sales. In many cases, this will require a dramatically different sales approach.

In addition, many hobby stores are poorly managed. These stores are often operated as labours of love rather than as profitable businesses. As a result, a number of stores have gone under, often closed down by the banks to whom money is long overdue.

The third and final type of computer store is the retailing center operated by a large vendor. Digital Equipment Corporation, for example, currently has fifteen stores in the US. The company plans on enlarging that number to two hundred in the near future. Systems capable of both word- and data-processing are offered, and the target customer is the small business that wants a reliable and efficient system backed up by a company known for good customer support.

These customers neither like nor dislike computers. They do like the idea that computers will save them time and money. They are generally willing to spend more for a system from a well-known vendor than for a comparable but less reputable system. In this respect, buying a small computer from Digital is similar to buying a big one from IBM: in both cases the order is largely based on the vendor's reputation.

The sales pitch in these retailing centres is noticeably free of buzz words and technical information. Rather, the accent is on what the systems can do and how they can assist the small business in a way that makes good economic sense. There is a willingness to educate the customer if necessary, and Digital's stores offer classes and how-to books. Like the large merchandisers, these retailers are trying to take the mystery out of computers. They are, instead, presenting computers as machines that are as practical and useful as office copiers and desk calculators.

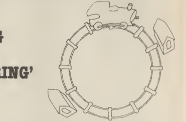
If there is one unifying feature among the retailers, it is a new emphasis on salesmanship. As competition increases among computer stores, those doing the best job of selling will succeed. In addition, computers are increasingly being sold as a commodity. They are being sold to users bereft of a technological background: parents, lawyers and school administrators, to name a few. These customers do not care how a computer works — they are only interested in the end results. Thus, marketing strategy follows suit.

A new twist on the need for improved marketing skill is taking place among the OEMs. Contracts between vendors and OEMs generally allow the latter to purchase systems on a 35 per cent discount, provided that they contribute what is known as 'added value'. This has usually meant that custom software designed by the OEM was sold along with the vendor's computer, forming a package. Recently, however, some OEMs have sold unaltered systems 'out of the box', with the added value being only their sales expertise.

According to a reputable source within the retailing industry, large vendors are allowing this when it is to their advantage. Companies like Digital are defining 'added value' as the situation requires. For example, in a geographical area where a vendor has few or no salespeople of its own, it will allow OEMs to sell its unmodified systems and still buy at the discount price. If the vendor decides to step up its sales force, however, it may crack down on the OEMs and forbid the procedure, this time using the older interpretation of the added value requirement.

Thus, for the OEMs, as well as for the retailers, improved salesmanship is becoming an increasingly important aspect of the business. Just how this will affect the industry as a whole will be worth watching. ■

USING A DIGITAL 'RING'



[illegible] *Computing Laboratory*
[illegible]

As the cost of computer processing power falls so the ability to process information by computer comes within grasp of more and more people. There has always been plenty of information about to process but we have never been able to churn it over as fast or as cheaply as we can now. It is going to become cheaper and probably faster for a while yet.

A consequence of central processors becoming faster is that information in the form of the program must be moved into the processor faster and results taken away from it faster. Give the central processor a good operating system and it is able to work on a number of programs apparently all at once. This is possible because information transfer to and from the processor is slow compared to the time taken processing that information. The processor works on a second program while other parts of hardware move information around for the first. Speed the processor up further and it is able to deal with several batch jobs, a number of users sitting at terminals and its own peripherals.

A consequence of processing power becoming cheaper is that rather than troubling the main computer to delete a character mistyped by a user, for example, it is more economic to place a less powerful cheap processor in between a user and the main computer to deal with trivial tasks similar to this. An example of this is the so-called intelligent terminal.

But these cheap processors have become more powerful. So now cheap powerful processors connect a number of users to a main computer. In fact, rather than having an operating system in a powerful machine which provides a number of facilities — several languages, a multi user system, peripheral drivers etc — research is being concentrated on methods of connecting machines of a less powerful nature together, *each of which has a dedicated function to perform.* There is already a machine which is ideally suited to running Pascal programs, and it is possible to program a moderately sized microprocessor to control a number of line printers, one cheap enough to dedicate solely to this task.

All these individual processors will need to communicate with one another and at a good speed. The problems associated with this are well understood. Some readers may have tried connecting machines from different manufacturers together.

Suddenly, in the midst of the technological revolution, we have found the communications problem. Particularly, we need high speed communication between two points.

The Cambridge RING

A RING type of network is one of the solutions to this problem. It is described by its name and consists of a loop of wires. Data for transmission is put onto the RING at one point, the source, and pulled off at another, the destination. Points around the RING need to have an identification of some sort and are given a unique address. Each point must therefore have some means of recognising information destined for it and marking information so that the desired destination recognises it. Any two points on the RING may converse with one another. If this is the case destinations will need to know who is sending information, as there may be two transmissions in succession to one destination. Similarly, sources will want to know if a transmission was successful or not, or even if a destination is switched on.

Given that fire, flood, rebellion and nuclear attack are likely to cause a few niggling errors on the network, it would be wise to include some error checking facility.

The RING solves these problems by using a transmission structure based on a packet of information. I find it useful to think of the RING as a loop of railway track, with an integer number of trucks on it. Electrically the RING is a loop of wires, with an integer number of 'bits' on it. A RING PACKET contains all of the important pieces of information. It is made up along the following lines.

Returning to the train analogy, imagine that 50 trucks (bits) could be fitted onto the loop of track with no space between any of them. Each is connected to the next, with the last connected to the first. A RING packet would consist of 38 trucks (bits) connected together. There are 12 trucks left, which is not enough for another complete packet. Each of the trucks may carry a full load (bit set) or no load (bit cleared) at all. The RING packet sequence of trucks is defined to start with a full truck. Trucks within the packet might be full or empty. The remaining 12 trucks are defined to be always empty.

If the trucks on the loop are then rotated round the loop in one direction and are observed from a station on the loop in such a way that only one truck is visible at a time as it passes, it is not possible to determine

1	2	3	4 – 11	12 – 19	20 – 35	36 – 37	38
Start of Packet	Full/Empty	Monitor Passed Check	Destination Address	Source Address	Data Bits	Response Bits	Parity Bit

Fig 1 RING PACKET STRUCTURE

where the RING packet of trucks starts without an initial knowledge of the layout of the trucks on the loop. The situation is made more interesting if the size of the loop of track and therefore the number of trucks it will hold, is not known.

It becomes clear that points on the RING, where information is going to be injected and removed, need to have some intelligence. They need to be able to fix on the structure of bits on the RING and to know where they are within this structure.

A working Cambridge RING consists of a MONITOR STATION, one REPEATER, a RING POWER SUPPLY and a length of twin twisted pair cable. The Monitor Station is electrically informed of the number of complete packets in the RING and for the moment there will be one packet only. When the RING is switched on, the Monitor Station looks for a passing bit of data analogous to any loaded truck. Once it sees this single data bit, the Monitor Station allows it to continue and it forces the next bit set as well. Further passing bits are forced clear. While the data is in flight around the RING, the Monitor Station counts the number of bits passing, forcing them all to be zero. For a single packet RING, the Monitor Station counts up to 38, which is the length of one packet, and then counts again from zero until the initial two bits of in flight data return. When the data returns, the counter will contain the number of bits remaining in the RING after one complete packet has passed. The Monitor Station now has enough information itself to enforce this RING structure for the rest of the time the RING is switched on.

The data bits on the Cambridge RING travel along cable. The data is coded in such a way that two pairs of wires are needed for transmission. The cable itself does not need to be special and was intended to be similar to that used for terminal connection. The encoded data travelling in this cable needs to be amplified every 100 metres or so and this is the purpose of the REPEATERS.

Repeaters perform three functions. They amplify the data signal, they unscramble it from its encoded form into a normal serial stream of data and then rescramble it for transmission, and they allow the data to be changed. The unscrambled data bits are analogous to the passing trucks, viewed one at a time from the station. The RING power supply injects power into the cable used for the data transmission. Each Repeater extracts some of this power and uses it to supply itself.

With this arrangement of RING equipment, data is sent from the Monitor Station to itself. The Monitor Station injects the data via the Repeater and receives it back through the same Repeater. As it stands this is of no practical use other than to verify the correct operation of the RING.

During the initial starting sequence of the Monitor Station a single RING packet is travelling around the RING. The first two bits of this packet are set and the rest clear. The remaining bits circulating after the packet are also clear. With this initial structure imposed on the trucks, it would be possible for the observer in the station to work out where the packet starts. If he looks and sees a full truck it will be one of the two initial bits of the packet. If he sees an empty truck, then he waits for a full one and that is the first bit of the packet. If he first looks when the second full truck is passing, his assumption that this is the first bit of the packet will be corrected the next time the packet of trucks passes.

Processing

This is a description of the initialisation procedure of the WORK STATION. This fourth piece of RING equipment is used to determine the RING structure and then transmit and receive packets of information from the RING at correct times within the structure. Initially, while the Monitor Station is initialising the RING, the Work Station has an ideal data stream to synchronise on. Only the first two bits of every packet are set and the rest are clear.

If the Work Station knows the number of packets in the RING, then the method of synchronisation is simple. Wait for a set bit, count to 38 the correct number of times and then count the remaining clear bits. If the Work Station tries to synchronise on the wrong set bit, then it detects this and has another go. The Work Station is able to detect RING structure errors because it, like the Monitor Station, remembers the structure all the time the RING is running.

Each Work Station must have a Repeater connected to it to do the encoding and decoding of the data stream. To be able to change the data on the RING, a Repeater must have a Work Station connected to it. I term this combination of one Repeater and one Work Station a RING NODE.

A Service RING

With the four pieces of RING equipment described simply above, a powerful communications network can be built up. The most important piece of this equipment is the Monitor Station. Apart from executing its duties to set the RING up, the Monitor Station also keeps a watchful eye on the RING structure, detecting errors and counting them. If the RING structure collapses for some reason, the Monitor Station will attempt to recreate it. If it fails to recreate the structure after a number of attempts, it will switch the RING off. Both the Monitor Station and the Work Station are able to send FAULT PACKETS to a destination whose address is always zero. The Monitor Station sends these Fault Packets whenever it detects errors in the structure of the RING generally, or whenever it detects a parity error within a packet. The Monitor Station also uses free packets to check the overall working of the RING by sending random data into a packet and checking that it has not changed on its return.

A brief description of the significance of the various bits within a RING packet is now in order. Referring to Fig 1, the packet is 38 bits long. The first bit is always a one to distinguish it from the GAP bits. The GAP bits are the remainder bits which pad the RING out to its working length. In the 5th truck for example, the GAP would be the 1 empty remaining trucks. The second bit is set if the packet is full, i.e. is being used to transmit information between two of the points on the RING. The third bit is set by the Monitor Station when a full packet goes past it for the first time. This will be explained in more detail later. Bits 4 to 11 are designated the Destination Address field and are set to indicate which of a possible 253 destinations are to receive the packet. Addresses all zero (0) and all one (255) are reserved for testing and fault packet capture. Bits 12 to 19 are for the source address of the transmitting Work Station. Again this will contain a number between 1 and 253. The next 16 bits are for data, and of the remaining 3 bits, 2 are used by the destination to mark its response to the packet it just received, and the last bit is a parity bit.

Packets transmitted on the RING make one complete revolution before they are freed and available for use by other Work Stations. When a packet is sent by a source it is marked as being full and the response bits are cleared. The source address bits in the packet are set by the Work Station to its own address as it is the source sending the packet. When the packet reaches the destination whose address matches that described by the destination address bits of the packet, the response bits are set depending on whether the packet was:

- 1) received correctly by the destination
- 2) rejected because the Work Station was busy dealing with another source's packet
- 3) rejected because the Work Station was concentrating on one other source only, or
- 4) ignored totally. The Work Station was not switched on, for example.

The free packet then continues round the RING back to the source which sent it. The source then checks the bits in the packet to see if any are in error, notes if any are, and marks the packet empty. The packet then continues round the RING.

At some stage while the packet is in flight, it will pass the Monitor Station where the Monitor Passed Once bit is set. Packets passing the Monitor Station should never have this bit set. If a packet arrives with this bit set then it is an error packet, as it has been round more than once without any destination picking it up or any source freeing it. The Monitor Station frees any packets in this state so that they are again available. Obviously packets are checked by every active Work Station to see if they are for them. In addition to this, each active Work Station calculates the parity of the passing packet and compares it with the actual parity bit in the packet; the Work Station notes if the two differ.

The Monitor Station and Work Stations keep watch on the data and note any errors. If an error is detected by either the Monitor Station or a Work Station then a Fault Packet is sent to destination zero as mentioned above. The Fault Packet contains the address of the Station which acts as address zero. If a Work Station with address zero is put in the RING just before the Monitor Station then Fault Packets will be removed by this Work Station and could be interpreted by a computer. If the [illegible] carrying the RING signals are cut so that the loop is broken the Work Station downstream from the break receives a stream of zero bits. Circuitry in the Work Station combines bits in packets and the [illegible] after a while and one set bit is passed into the RING. As the Work Station is full duplex the receive circuit then sees this bit and thinks that it signifies the start of a packet. However, after the required [illegible] bits it has not received any other set bits and therefore the parity bits wrong. It then waits until the next apparent packet arrives which will be generated in the same way as the erroneous single bit and constructs a Fault Packet. The Fault Packet will travel round the RING to all the other Work Stations and will eventually be detected. In this RING break situation a stream of these fault packets arrives at address zero from the same source. This may be interpreted by a computer watching the Fault Packets and it could predict with fair certainty that the RING was broken just before the Work Station which was sending the Fault Packets.

Processing

As well as transmitting, receiving and checking for errors the Work Station has one other useful feature. It is able to select packets from those transmitted to it which have been sent from one particular source.

It can also be set up to ignore all packets or to accept all packets. An example of the use of this feature is as follows. Assume that a computer is attached to the Work Station initially; the Work Station is set up by its attached computer to listen to all packets sent to it. When it receives one the listening computer can select that source for further reception until the end of the transmission. This mechanism prevents the computer from being disturbed unnecessarily to deal with packets from sources it is not currently interested in. Stations sending packets to a destination which is deaf to them will see from the response bits of the returning packets that their data has been ignored.

This is a simple description of the operation of the Cambridge RING. I have glossed over many of the features resulting from the care with which this particular network has been designed, and have not mentioned how the RING is physically connected to equipment wishing to use it.

The Computing Laboratory of the University of Kent at Canterbury is engaged in research on the Cambridge RING and now has a RING in operation with seven machines connected to it. The RING is used to load the relevant software into the machines and for transfer of data between them.

An important point that I neglected to mention is that the RING runs at ten million bits per second. The measured error rate is better than one bit in 100 000 000 000 at this speed.

Here, then, is one of the answers to the high speed communications problem. Researchers now have one tool they may use to shift all that information around quickly and reliably. ■

Author's Note

The Cambridge RING was originally conceived and designed by Professor M V Wilkes and Professor D J Wheeler at the University of Cambridge Computing Laboratory.

Without past and continuing help from some members of that laboratory our own RING project could not have been as successful as it has been to date.

SMALL WONDERS from SYSTEMS PLUS

The Vector Graphic MZ

- 4MHZ Z80A CPU
- 56K RAM
- 630K bytes disk storage
- Serial port and two parallel ports
- Prom/ram board with monitor
- MDOS operating system
- Z80 Assembler
- Easily enhanced to multi user operation.

£2 850

Texas Instrument TI 810

- 150 CPS
- 9 x 7 dot matrix
- Self test
- Up to 132 chs/line
- U + L case

£1,350

The Vector Graphic System B

- Vector Graphic MZ plus
- Vector Mindless terminal
- Flashwriter 2 video board (24 x 80)
- MZos operating system
- CP/M operating system

£3,350

Microtek MT—80 Printer

- 125 cps
- 9 x 7 dot matrix
- Self test
- 80/120 chs line
- U + L case

£680

Qume Sprint 5

- Complete with tractor feed £1 825
- Sheet Feeder £800

Now available for the serious applications programmer the ULTIMATE SOFTWARE TOOL
a full Data Management System for micro computers

M D B S

- Versatile and Flexible
- CODASYL orientated
- Slashes cost of software development
- Z—80 based
- Supports multi-drive data bases
  Either floppies or hard disk

Package includes DDL Analyser/Editor comprehensive User Manual, Data Management Routines, sample Application Programs, Introductory Price £650

SYSTEMS PLUS

19c GLENGORMLEY PARK, GLENGORMLEY CO ANTRIM N IRELAND Telephone Glengormley 42117

PO Box 2
St Neots
Cambridgeshire

Dear Sir

The benefits of word processing are here for all!
The **Comart VDM** Video Display Module plugs easily into the North Star Horizon Computer S100 Bus and together with the Comart Monitor and VDM *Starword processing software provides the facilities of **"instant display"** word processing on a general purpose microcomputer.

Text may be entered, edited and standard paragraphs inserted with true upper & lower case display then rapidly and simply printed in chosen format.

The VDM means that the Horizon can be your [illegible] word processor yet change to [illegible] software and be returned to use as a general purpose Computer ... **Real flexibility!**

Contact us direct or call your nearest Comart dealer

CAMBRIDGE **CAMBRIDGE COMPUTER STORE** Cambridge [illegible]
CAMBERLEY **MICROBITS** Camberley Surrey 0276 [illegible]
ILFORD **THE BYTE SHOP** Ilford [illegible] 554 [illegible]
[illegible] Road [illegible]
LEEDS **HOLDENE LIMITED** Leeds 0532 459459
[illegible] Cheshire 0625 [illegible]
LONDON **SIGITUS LIMITED** London W [illegible]
LUTON **ISHERWOODS** Luton [illegible]

MANCHESTER **MICROCOMPUTERMART** Manchester 061-83[illegible]
[illegible] West Park Leeds (0532) 786[illegible]
NEWBURY **NEWBEAR COMPUTING STORE** Newbury Berks 0635 [illegible]
[illegible] Stockport [illegible] 061 491 2290
NEWPORT **MICROMEDIA SYSTEMS** Newport Gwent (0633) 505[illegible]
NOTTINGHAM **COMPUTERLAND LIMITED** Nottingham 0602 405[illegible]
[illegible] Birmingham [illegible]
Manchester 061 236 8737
[illegible] 2468
SHEFFIELD **HALLAM COMPUTER SYSTEMS** Sheffield 0742 [illegible]
SOUTHAMPTON **XITAN SYSTEMS LIMITED** Southampton [illegible]

comart specialists in microcomputers

Comart Ltd, P.O. Box 2 St. Neots Huntingdon Cambs PE19 2AF Tel (0480) 215005 Telex 32514

KEEPING YOUR COMPUTER BUSY

In this series Paul [illegible] readers to the [illegible] operating systems [illegible] the practical use of [illegible] in assembler and [illegible] describing some [illegible] guages such as C [illegible] and ADA. The [illegible] experience in [illegible] real time and [illegible] or computer [illegible] ing a multi [illegible] houses [illegible] Z80 and Z8000 chips in about the middle of 1980

Here is your nice new microcomputer. It can execute one-third of a million instructions a second and you've just written a program for it. The program prompts you, asking for a six digit value, and you respond by typing in the six digits terminated by pressing the ENTER key.

How long did it take you to enter that number? Three seconds? Now consider what the computer was doing during that time. To input and store a single digit requires the execution of about twenty machine instructions if you have written in assembler or about fifty instructions if the program was in a high level language like BASIC, or about two hundred instructions in all. But during those three seconds your micro could have executed a million instructions. So what happened to the rest of the instructions? Well, your microprocessor spent the rest of its time just looping round, waiting for something to happen.

In this series of articles we shall be looking at some of the ways in which most [illegible] can be utilised to run more than one [illegible] on at a time or to have [illegible] running on more [illegible]. The scope of these [illegible] limited to looking at Run time [illegible] only the types of systems [illegible] programs actually [illegible] not the sort of system that [illegible] your programs. [illegible] development systems with [illegible] and compilers [illegible] require a far greater [illegible] than the type of system [illegible] with the requirements [illegible] programs.

The main approaches

First we have to look at the two main approaches to the problem of running more than one program at a time on a single computer system.

- TIME SHARING in its simplest is just a matter of dividing the computer time available into small units referred to as slices, and then to give each user full control of the computer for one slice, and then giving the next slice to the next user in turn. If the slices are fractions of a second and there are only three or four users, then it appears to each of them that they have sole use of the computer. If the user who is due to receive the next time slice is awaiting some input or some output, then he will miss his turn, as the time slice will be given to the next user who can make use of the processing time.

- With MULTI PROGRAMMING systems the approach is a little different. The programs are sorted into order of importance (PRIORITY) and full use of the system is given to the most important program. When that program has to wait for some input or output it offers the use of the computer to the second program in order of importance, on condition that it can reclaim the computer as soon as it needs it. If this second program cannot use the processing time, then it can offer it to the next program in order, and so on down the list.

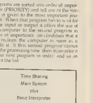


Fig 1 Layout of Time-sharing System in memory

With both Time sharing and Multi program systems, when the user program requires input/output (I/O), it does not handle the I/O device itself but issues a call to the OPERATING SYSTEM. It is this operating system that carries out all the

Operating Systems

input and output as well as making the decisions about the allocation of the computer's resources (this term encompasses all the aspects of a computer that are required to run a program: processing time, memory space, storage devices, input devices etc). With the operating system insulating the program from the problems involved in communicating with the outside world and with files on disc the programmer is free to devote his efforts to writing his program.

At this point we have to introduce the concept of an INTERRUPT. This is when something outside of the central processing unit interrupts the current program being executed. Instead of a program looping round waiting for a character to be input from the keyboard, it can instead request the input of a character and give the inputting device the ability to get the computer's attention when it finally does have a character ready. The computer will store away the input, tell the device to get another character and then carry on processing from the point at which it was interrupted. It is not only devices handling I/O that can interrupt: one of the most common interrupt devices is a Real Time Clock. This device is set to cause an interrupt at constant intervals, typically one-fiftieth of a second, and is used by the system both to monitor the passing of time and to initiate time related actions — such as ending a time-slice.

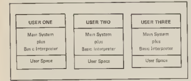


Fig 2 *How the Users see the Time-sharing System*

As an alternative to giving each device the ability to interrupt, you can get by with having the clock interrupt cause the computer to check all the devices to see if any of them have data ready for the computer. This approach is normally termed POLLING.

Interrupt handling

How does the computer handle interrupts? There are two ways:

- The simplest is for the computer to start executing a routine that looks round all the devices (in the same way as a polling routine), identifies the device causing the interrupt and then jumps to a routine that services that particular device.
- The other common method is for the interrupting device to identify itself to the computer and then control is passed straight to the correct service routine.

With both these methods the exit from the interrupt condition is a 'return from interrupt' instruction which causes the computer to resume execution from the point at which it was interrupted.

We have now seen two instances of control being passed from an application program (or user) to the operating system: when a program requests I/O and when a device interrupts. These entries to the operating system are termed EVENTS.

Whenever an event occurs the operating system has to check to see if the distribution of resources has to change.

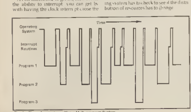


Fig 3 *Flow of execution within a Multi program System*

In a multi programming system an interruption that signals the completion of an I/O request from a high-priority program received during the execution of a low priority job will cause the low priority job to be suspended and the high priority job to receive control again. This constant suspending and reactivating of programs is called SCHEDULING.

So far we have seen that we can have more than one program running in a computer by providing an operating system that shares out resources among the programs according to the effects of events. Now, forgetting about time sharing for the time being, we will look at the other services that an operating system needs to provide for users.

The first thing that is required for the execution of a program is an area of memory to load the code into, and later it will probably require somewhere to read data into and somewhere to setup the output.

The Memory Manager will handle the dynamic allocation of the available memory space. It does this by dividing the free space into units, say 128 bytes each, and then keeping a table with an entry in it for each unit of space. When a request is made for some space it translates the requirement into units, then that number of consecutive units have their entry in the table changed to 'allocated' and the start address of the start of the area is returned to the user. When the space is no longer required, the user gives it back to the Memory Manager, and it is marked as available in the table.

Next, the user program will require a terminal to use, if it hasn't already got one, and later it might require access to a printer for output. The system then has to provide exclusive access to devices as well as actually handling the devices.

At some time during its execution the program will want to access data records on one of the computer's discs. The system has to cope with requests (to open or to access files) arriving faster than they can be satisfied, for with floppy disc controllers only one access can take place at a time. To cope with this situation the system will *queue* requests in such an order that the disc head has to travel the shortest possible distance between the requested blocks.

When two users are allowed to update the same file at the same time, it must prevent them trying to update the same record at the same time. If a second user reads a record after it has just been read and then both users change it and write it back at different times, then the second user to write back the record will over-write the copy containing the first set of changes with a copy of the record that only has the second set of changes, the first set being lost. To prevent this the system provides users with the facility to LOCK records. A locked record cannot be accessed for update until the user that locked it unlocks it. This locking can be applied to a whole file if required — for instance, when running a sort program.

These then are the basic facilities that an operating system should provide. There are a number of other facilities that [illegible] system.

Most [illegible] programs are SEQUENTIAL [illegible] portion of the code proceeds sequentially one section after another [illegible] one section). This [illegible] programs to be debugged [illegible] for if you repeatedly give [illegible] same set of data to work upon [illegible] repeatedly produce the same [illegible] It [illegible] make changes to your [illegible] then you can monitor the changes by [illegible] storing the results of the program.

But what would happen if when you repeatedly gave your program the same data it kept producing different results? Well, this is a distinct possibility when two or more programs or users of the same program can require access to the same database.

Consider the sequence of code in a program between two calls to the operating system as a section. Now because each of the programs is trying to run independently their calls on the operating system for services will occur randomly, also the requests will, according to what they are, take different times to satisfy. Each of the programs will probably have a different priority as well. Taking all these factors into account and looking at all the sections of code that are in the computer instead of just in one program, perhaps you can appreciate how unlikely it is that all these sections will be executed in exact

Operating Systems

[illegible] time. And so the repeatability that aids the testing of single [illegible] does not exist in a multi user system. [illegible] the same database by [illegible] in the particular order AFTER [illegible] program has used a variable that [illegible] with one of the other programs [illegible] cause the system to crash [illegible] three actions causes an [illegible] Getting rid of the fault [illegible] purely because it may take [illegible] of crashes before you [illegible] the combination of circumstances that produce the fault and only then [illegible] look for the bug.

'But it is only half of the problem'

That may sound bad but it is only half of the problem. For that system didn't have any interrupts in it. Interrupts happen as a result of external circumstances and so their timings are independent of what the programs are doing. Above all is the critical fact that interrupts don't only happen between sections of code — they can happen between any two individual instructions in the computer. Interrupts cause the execution of an interrupt service routine and may also cause rescheduling of the system. So how many permutations of the sequence in which individual instructions can be executed does that give?

You will be glad to know that a lot of time and effort has gone into the problem of finding ways of developing systems where multiple programs execute CONCURRENTLY. In the next of these articles we shall start to look at the theory of concurrent programming before going on to practical examples.

Before finishing we should look at another of the problems involved in multiple program systems — deadly embrace. Consider two programs running in a computer. Program 1 requests sole access to a file on the disc and program 2 claims the printer. Now program 1 requests the printer for output and program 2 requests access to the same file as program 1. What does the operating system do? Program 1 cannot proceed until the printer is ready and program 2, which has the printer, cannot proceed to termination, thus freeing the printer, because program 1 is preventing it from accessing the file. Although only a simple example this does show you what deadly embrace is.

Can you think of some other examples of this problem (for instance regarding requests for memory)? Can you suggest a cure? You have a month to think about it. ■

We offer a complete service!

When you buy a computer from us — we don't give you the box and wave goodbye!
We realise this is a major purchase for a Company and take the time to find out your requirements, design your computer system and write the software, or if you prefer to write your own we will always be available to advise you.
You can buy a wide range of fully documented packages — Word Processing/Purchase & Sales Ledgers/Stock Control/Incomplete Records/Medical Systems/Teaching Programs etc. on Microcomputers such as —

Apple II
from £750 (16K)
A complete business system
48K Apple, 2 Disk Drives
VDU & Printer £2 500

Microstar
from £4 950
Multi user/Multi-task
1 2/2 4 or 4 8 mb
A complete system with
2 VDUs & Printer £7 000

Alpha Micro
from £9,950
From 1 to 32 terminals
From 10mb to 90mb disk storage
16 bit processor Multi
user operating system

• prices ex VAT

We stock a full range of VDUs, Printers, Computer Stationery, Diskettes, Disk Boxes etc

Low cost Printerm
£695 matrix printer

Lear Siegler
200A matrix printer £1 650

Qume Sprint 5
daisywheel printer £2 115

Come and see us to discuss your requirements and have a demonstration

MICROSOLVE

Microsolve Computer Services Ltd
3rd Floor, Middlesex House, High Street,
Edgware, Middx. Tel. 01 951 0218/9
M 1 junction 4/20 mins from Central London

New Produced and widely used in England and U.S.A.

COMPLETE BUSINESS PACKAGE

INCLUDES EVERYTHING FROM INVENTORY TO SALES SUMMARY
PROMPTS USER, VALIDATES EACH ENTRY, MENU DRIVEN

Approximately 80-100 entries/inputs require only 2-4 hours weekly and your entire business is under control

* PROGRAMS ARE INTEGRATED-

01 = ENTER NAMES/ADDRESS ETC
02 = *ENTER/PRINT INVOICES
03 = *ENTER PURCHASES
04 = *ENTER A C RECEIVABLES
05 = *ENTER A C PAYABLES
06 = ENTER/UPDATE INVENTORY
07 = ENTER UPDATE ORDERS
08 = ENTER UPDATE BANKS
09 = EXAMINE MONITOR SALES LEDGER
10 = EXAMINE/MONITOR PURCHASE LEDGER
11 = EXAMINE/MONITOR (INCOMPLETE RECORDS)
12 = EXAMINE PRODUCT SALES

SELECT FUNCTION BY NUMBER-

13 = PRINT CUSTOMER STATEMENTS
14 = PRINT SUPPLIER STATEMENTS
15 = PRINT AGENT STATEMENTS
16 = PRINT TAX STATEMENTS
17 = PRINT WEEK MONTH SALES
18 = PRINT WEEK/MONTH PURCHASES
19 = PRINT YEAR AUDIT
20 = PRINT PROFIT LOSS ACCOUNT
21 = UPDATE END MONTH FILES MAINTENANCE
22 = PRINT CASH FLOW FORECAST
23 = ENTER/UPDATE PAYROLL (NOT YET AVAILABLE)
24 = RETURN TO BASIC

WHICH ONE? (ENTER 1-24)

01 SUS MENU EXAMPLE 01 = EXAMINE 02 = INSERT 03 = AMEND 04 = DELETE
05 = PRINT (1,2,3) 06 = NUMERIC COMBINATIONS 07 = SORT

VERY FLEXIBLE. ADD YOUR OWN FUNCTIONS EASY TO INTEGRATE

All programs in BASIC for CP/M PET 8800

G W COMPUTERS LTD the producers of this beautiful package

WE EXPORT TO ALL COUNTRIES CALLERS BY APPOINTMENT OR CONTACT TONY WINTER 01-636 8210

89 Bedford Court Mansions
Bedford Avenue
London WC1, U.K.

PRICES: Programs 1-23 EXC (19,20,22,23) £475 Inclusive £575 Stock integrated Option + £100 Bank Integrated Option £100.

IMPORTANT! We also sell the Hardware to do the above tasks so you can do the complete purchase at one source.

• PET • PET • PET • PET • PET • PET

PET COMPUTER 32K	£795 00
PET Floppy Disk	£795 00
PET Printer T/Feed	£645 00
PET Cables	£45 00
PAPER	£28 60
10 Diskettes	£26 50
1 year's software support	£50 00
	£2387 00

• SUPERBRAIN • SUPERBRAIN •

Twin Floppy D Density 5¼ 64K RAM	£1850 00

• PRINTER OPTIONS • PRINTER OPTIONS

a)	Paper Tiger	195 cps	£585
b)	Texas 810	150 cps	£1435
c)	Teletype 43	30 cps	£895
d)	DEC LA34	30 cps	£895
e)	QUME Daisywheel	45 cps	£2450
f)	NEC Spinwriter	55 cps	£1950

• SPECIALS • SPECIALS • SPECIALS •

48K Industrial Microsystems and Twin D Drives 5¼	£2000
Intertube Video Terminals	£485
40K SWTP 6800 & Twin S/Density 5¼ Drives	£100

• SOFTWARE • SOFTWARE •

CPM MBASIC - 80	£150
CPM FORTRAN 80	£200
CPM COBOL - 80	£320
CPM WORD STAR	£250
CPM PASCAL - M	£200
CPM BSTAM	£75
CPM SUPERSORT	£120
PET Comaccounts	£650
PET Compay	£150
PET Combis/Comstock	£150
PET Wordpro	£75
PET Super Comword	£150

- Walkie Talkie Telephone (Freedom Phone) Connects to normal telephone make or take calls 300ft from home £195 (not P O Approved)
- Telephone Answering Machine Recall Message anywhere in World £195 (not P O Approved)
- Call for Special All-in Deal Offers
- Warranty includes free replacement of equipment within 90 days if found defective
- Superbrain dealer enquiries invited

WE EXPORT TO ALL COUNTRIES CALLERS BY APPOINTMENT OR CONTACT TONY WINTER 01-636 8210

89 Bedford Court Mansions
Bedford Avenue
London WC1, U.K.

PLEASE CALL ONLY BY APPOINTMENT

BRAND NEWs

Issue four

compiled by Microspy

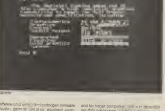
This middle section may either be pulled out or photocopied then filed for reference It will be comprehensive and range over the whole field of products services events and courses **PU** stands for Personal User **SB** stands for small base – that is small budget or small business **MB** – medium base medium budget or medium business **BB** – big base big budget or big business Addresses are to be found at the end of **Brand News.**

Systems

ADDS (UK) LTD
System 75 Based on Intel 8080 can be either stand alone or mainframe linked 52 Kbyte memory plus 1 5 Mbyte on diskettes (IBM compatible) *Software* Modular sales ledger nominal & purchase payroll stock control Additional software from specialist houses incomplete records farm management retail stores stock management production scheduling market analysis **MB, BB**

HEWLETT-PACKARD
HP85 personal computer for professionals (See photo this issue article by Rodney Drew) Memory 16 Kbytes read write 14 5 for user Expandable to 32K through memory module attachment to an input output port Language HP85 BASIC meets and exceeds recent ANSI standard 12 digit accuracy string operations editing 42 predefined functions 4 level program security interactive graphic curve fitting distribution analysis charts printer doubles as plotter Keyboard alpha numeric keyboard user definable keys display editing system control keys CRT display 5 black and white 16 lines by 32 chs displayed 64 lines available by scrolling Graphics mode 256 by 192 dot field Printer THERMAL 2 by 32 character lines per second Full 1?2 ch ASCII underlining Tape drive 21? Kbytes 1? per second

MS 109 Line Interface Module (LIM)



Appletel

Software on pre-recorded cartridges available includes general statistics electrical engineering finance linear programming regression analysis Owner s manual £1950 plus VAT **PU, SB**

TESDATA
MS(AMS) Computer Resource Management System Performance information for management control of computers and data communications Measures include Terminal response time line availability and usage central processor utilisation processor overhead critical resources long term utilisation trends network activity channel loads data base activity contention for resources NOW ENHANCED BY MS 109 Telecommunication Management System extended from computer room to communications networks and online terminals **BB**

IBM
5280 Distributed Data System Family of devices that can be programmed to enter validate store process and print business information at the point of origin Designed for use by employees who originate data Vendor states low cost particularly suitable to manufacturing construction distribution transportation and retail industries Can communicate with other IBM computer systems **MB BB**

DATASAAB
Series 16 family of business computers ' ideal for first time user vendor states to automate processing inventory functions and for larger companies [illegible] decentralise data processing COBOL language used MINIMUM System 16 1 18 Kbytes 10 Mbyte disc storage printer 100 lpm or 120 cps single workstation Enhancements to 64 96 128 192 and 256 Kbytes 24 30 60 Mbyte drives extra to give maximum 240 Mbytes on the three larger models From £17500 *Software* standard packages See Applications — Systems designed ergonomically **MB BB**

Applications

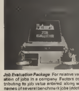
MICROSENSE COMPUTERS
Appletel **— Prestel package Post Office approved available now Developed by Owl Computers from APPLE communications card, allows APPLE Users to access Prestel information retrieval facilities Comprises communications card modified to Prestel standards, master disc holding program and Prestel user information protected lead linking APPLE to Post Office modem operating manual Software updates guaranteed £585 additional, rent of modem from PO SB, MB (APPLE)**

BUSINESS COMPUTER (SYSTEMS) LTD
Wordprocessing package for XEROX small business systems Integrates data and word processing Full range of features includes

text deletion insertion document assembler scrolling search for string line or page centre text change format, underlining automatic hyphenation merging of two documents subscripts superscripts Available under licence £250 per year **MB** (Xerox Diablo 300 & Ranger 3200)

BUNZL DATA SYSTEMS
Financial and manufacturing systems Financial sales purchase ledgers financial management accounting (including nominal) payroll fixed asset accounting asset register with inflation accounting financial modelling *Manufacturing* bills of materials inventory stock management purchasing management, works order processing material requirement planning Systems supplemented by wordprocessing facility Available with computers or via telephone lines **MB BB** (DEC)

PETSOFT



Job Evaluation Package **For relative valuation of jobs in a company Factors contributing to job value entered along with names of several benchmark jobs (doctor policeman secretary, etc) Computer asks paired comparison questions produces job evaluation formula, with component job factors weighted Designed to help establish pay structures and grades For use by managers personnel departments consultants £25 plus VAT MB (PET)**

PACKAGE PROGRAMS LTD
1) *MMS General Ledger and Financial Reporting System* Database oriented for financial management and cost accounting Report generator automatic generation of budgets and recurring journal entries currency conversions automatic consolidations statistical accounting and graphical output For any machine with COBOL compiler From £10500 2) *MMS Accounts Payable System* Database open item system for control over cash flow details of supplier history & status reporting of future cash commitments Produces remittance advices cheques handles VAT has General Ledger interface standard report library purchase order control letters of credit/bank drafts Multicompany Multicurrency For any machine supporting COBOL From £4000 Other packages available A

BRAND NEWs

[illegible] and evalua tion [illegible] system [illegible] systems (for IPM [illegible] all packages [illegible] training options [illegible] after 1st year [illegible] 10 per [illegible] **MB BB**

DATASAAB
Applications packages for Series 15 (see Systems) Modular each package made up of subsystems and options Parameter driven Real time conversational mode integrated ODIN for order processing invoicing stock accounting THOR nominal accounting FREY sales ledger LOKI purchase ledger MIMER material and production control MIMER to be released 1980 other available now **MB BB**

VDUs, Graphics Terminals & Systems

CALCOMP LIMITED
Model 1065 DRUM PLOTTER [illegible] World Ink-on-paper drawings up to six feet wide resolution 0 0005 in 4 program selectable pens max axial plotting speed 30 ins sec Operable on off line remote timesharing For civil shipbuilding mining and garment industries **MB BB**

PENNY & GILES
Lear Siegler ADM 2 smart intelligent terminal Users of ADM-2 can upgrade without rewriting software Incorporates microprocessor CRT screen 15 diagonal P4 phosphor non glare faceplate 128 ch ASCII upper & lower case control characters 25 lines by 80 chs per line Dual intensity blinking fields blanking fields protected fields Characters 7 by 11 dot matrix Keyboard 26 letter alphabet upper and lower case numeric 0 to 9 punctuation break delete Functional control keys clear space clear null page edit, char insert/insert mode char delete line insert, line delete line erase page erase tab/backtab Terminal status display and mode Edit operations remote Edit operations keyboard Formatting aids Cursor control Page control Transmission and conversation modes Asynchronous baud rates from 50 to 9600 Options available Full two-page display is standard **MB OEMs** (Lear Siegler

TEKTRONIX
Dynamic Graphics Option 30 **to add greater interactivity to 4054 system (see *Brand News* Issue 3) Applications "to benefit", states vendor circuit schematics engineering designs facilities layout, architecture and landscaping, town planning, mapping and PERT charts Uses simple BASIC language commands MB BB Design Engineers**

Disks, Tapes, Punches, Readers

CPU PERIPHERALS
Shugart's new *SA1000 8 Fixed Disc Drive 1) Model 1002* 2 R/W heads 1 Disc 5 33 Mbytes per drive 2 67 Mbytes per surface 10 4 Kbytes per track unformatted 4 2 Mbytes per drive 2 1 Mbytes per surface 8 2 Kbytes per track 256 bytes per sector 32 sectors per track Transfer 4 34 Mbits per sec Access track to track 19 msec average 70 msec max 150 msec average latency 9 6 msec Rotational speed 3125 rpm *2) Model 1004* 4 R/W heads 2 Discs double the formatted and unformatted capacity of 1002 otherwise identical Air filtration system Floppy size package simple interface possible to daisy chain with floppies **MB, OEMs**

MODULAR BUSINESS SYSTEMS LTD
Elite Disc Unit 8 floxy disc soft sectored single or double sides 512 Kbytes formatted (IBM 3740 standard) when used with vendor's Elite processor single density disc controller (single sides) 1024 Kbytes formatted with Elite processor double density disc con

CALCOMP Model 1065 Drum Plotter

troller (single sided) Double the above capacities for double sided Service contracts available (ELITE Processor) **BB**

VERMONT RESEARCH
Model VRC 5017 3 Cartridge disc drive 1 removable cartridge 1 fixed disc Double sided 60 sectors per track 256 bytes per sector 52 x 10^6 bytes/drive 26 by 10^6 bytes per disc 12800 bytes/track 256 bytes/sector Average head positioning 40 ms Track to track 7 ms Max 70 ms 3185 rpm 3% Average latency 9 5ms Data transfer 673 4 Kbytes/sec Prerecorded clock derived from disc Non recoverable error rate 1 in 10^{10} recoverable 1 in 10^{12} bits (transferred) FORMATTER and Controller *Model 8400* **BB**

COMART
***Interface module (Model 7711)* for use with the 11 Mbyte IMI 8 Winchester technology disc drives (see *Brand News* issue 2) Module is an intelligent controller/formatter minimises hardware and software time taken to integrate the IMI drive with systems Controller software commands simple confined to read sector, write sector, format drive Automatic CRC (cyclic redundancy check) complete user flexibility in defining file sizes 8-bit wide parallel data interface of module employs simple handshake logic has status and error responses transfers data approx 50 Kbytes per sec Single board locates on existing backplane slot of IMI 7710 disc drive Ribbon cable connector SB OEMs**

Processor & Memory Board, Chips, Programmers, Test Instruments, Modules, Training Aids

ARROW COMPUTER SYSTEMS
Model 11E PROM Programmer LSI 11 compatible Onboard program logic Selectable parameters Multiple address modes 1) DEC standard 2) Contiguous word blocks addressed to any memory block with extended address to 132K words 3) Overlay (DEC LSI 11) **OEM.**

3D (Digital Design & Development)
PET style *IEEE 488 Bus Extender card* Vendor effective alternative Enables connection of 3 interfaces or devices on PET bus at once Comprises square pcb between 2 sheets of plastic four fingers along edges connection with double ended cables to PET cards can be chained £20 plus VAT Double ended cable ground line commoned to screen edge connector hooded £10 plus VAT **PU OEM Labs**

GP INDUSTRIAL ELECTRONICS
Eprom Erasers Models UV140 UV141 14 Eproms capacity UV source output 2537 Ang mains erase indicators 5 50 min timer (*Model 141*) erase time 20 min for 2708 Eprom *Model 140* £61 50 *141* 478 Exc VAT inc p&p **PU Labs**

BRAND NEWs

Shugart's new 8 in fixed disc drive series

KEEN COMPUTERS
SuperTalker word digitiser voice outputter peripheral from Mountain Hardware Card plugs into slot on APPLE2 microphone loudspeaker operating software documentation 2 programs supplied DOS for SuperTalker gives program control of speech direct I O routines permits creation of voice files on discette BASIC routines permit one line statements to output word phrase £190 assembled tested **PU OEM Labs** (APPLE)

LIGHTNING ELIMINATION ASSOCIATES
Powerline filter types *MB5* and *MB10* Designed to provide clean interference free mains supply protect against surges transients Vendor states particularly attractive to growing number small to medium sized user Provided with leads terminated with a standard 13 amp input plug output socket **SB MB**

MEKTRONIC
Communicator for PET allows external inputs outputs enables computer to act as controller Plugs directly into user port gives 8 channels bidirectional External 5 24 DC supply gives upto 50 mA (total max 2 5A) LED status indicators Software illustrates BASIC programming of controlled devices **PU Lab**

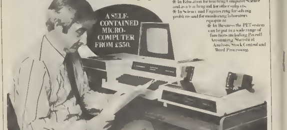
MICROSYSTEM SERVICES
Microsystem Test Console (MTC) Mobile production test console for mp systems Uses real time in circuit emulation & signature analysis faults diagnosed down to component level Stand alone or controllable by micro development system or any computer system Optional test bed extension built in power supply connections for board & small system testing Computer controlled mode fault trees look up tables storable in host host gives which point test probe should be connected to next. Signature analysis mode MTC probes component pins Bit streams generated by system or injected by in circuit emulator analysed hex representation output Faults located by comparing known good values

▶

K T R Hicas at 3D Workbench

Your Commodore PET System

The Commodore PET is Britain's best selling microcomputer and the most popular choice in every field:–



A SELF-CONTAINED MICRO-COMPUTER FROM £550.

- * In Education for teaching Computer Science and as a teaching aid for other subjects.
- * In Science and Engineering for solving problems and for monitoring laboratory equipment
- * In Business the PET system can be put to a wide range of functions including Payroll Accounting, Statistical Analysis, Stock Control and Word Processing.

Not least of its attractions is the price of a PET – from £550 for a self contained unit, to under £2,500 for the complete system including Floppy Disk Unit and high-speed Printer. Ask your nearest Commodore dealer below for details about Commodore hardware, software and training courses.

Our Dealer* Network

LONDON

Capital Computer Systems W1 [illegible]
RCE (by Tay TV Ltd) NW1 [illegible]
[illegible] Computer Centre [illegible]
Logic Box Ltd [illegible]
[illegible]
Advanced Management [illegible]
Mecyclea Ltd SW1 [illegible]
[illegible]

HOME COUNTIES

[illegible]
J.R. Ward Computers Ltd MILTON KEYNES [illegible]
[illegible] COLCHESTER [illegible]
South East Computers Ltd HASTINGS [illegible]
Symtec Systems Ltd SOUTHAMPTON [illegible]
[illegible] BANBURY [illegible]
[illegible] SOUTHAMPTON [illegible]
[illegible] ALTON [illegible]
[illegible]

[illegible]
[illegible] SOUTHAMPTON [illegible]
[illegible] BRIGHTON [illegible]
[illegible] HATFIELD [illegible]
[illegible] Computer Systems BEDFORD [illegible]
[illegible] LUTON [illegible]
[illegible] NORWICH [illegible]
CSE (Computers) READING [illegible]
[illegible] Systems WOODSTOCK [illegible]

MIDLANDS & STH HUMBERSIDE

[illegible] KNOWLE [illegible]
[illegible] NOTTINGHAM [illegible]
[illegible] DERBY [illegible]
[illegible] MATLOCK [illegible]
[illegible] DERBY [illegible]
[illegible] LEICESTER [illegible]
[illegible]

[illegible]
[illegible] WOLVERHAMPTON [illegible]

YORKSHIRE & NTH HUMBERSIDE

[illegible] HULL [illegible]
[illegible] LEEDS [illegible]
[illegible] SHEFFIELD [illegible]
[illegible] BRADFORD [illegible]
[illegible] SHEFFIELD [illegible]
[illegible]
[illegible] SHEFFIELD [illegible]

NORTH EAST

Currie & Maughan GATESHEAD [illegible]
[illegible]
[illegible] NEWCASTLE UPON TYNE [illegible]

SOUTH WALES & WEST COUNTRY

[illegible] BROADSTONE [illegible]
A.C. Systems EXETER [illegible]
[illegible] SWANSEA [illegible]
[illegible] CARDIFF [illegible]
[illegible] PAIGNTON [illegible]
[illegible] Computer Centre BRISTOL [illegible]
[illegible] PLYMOUTH [illegible]
[illegible] BRISTOL [illegible]
[illegible] BATH [illegible]
[illegible]

NORTH WEST & NORTH WALES

[illegible] BOLTON [illegible]
[illegible]
[illegible] BURNLEY [illegible]
[illegible] PRESTON [illegible]
[illegible] PRESTON [illegible]
[illegible] DOUGLAS [illegible]

LIVERPOOL

[illegible] LIVERPOOL [illegible]
[illegible]

MANCHESTER

Cytek (UK) Ltd MANCHESTER 832 7604
[illegible] MANCHESTER [illegible]
[illegible] Manchester Ltd [illegible]
Computer Workshop MANCHESTER [illegible]
[illegible] Computer Services Ltd OLDHAM [illegible]
[illegible] SALFORD [illegible]
[illegible]

SCOTLAND

[illegible] EDINBURGH [illegible]
[illegible] Computers [illegible]
[illegible] EDINBURGH [illegible]

IRELAND

[illegible]
[illegible] LISBURN [illegible]

[illegible]

commodore

We made small computers big business.

Commodore Information Centre, 360 Euston Road, NW1 3BL 01-388 5702

MICROSYSTEM SERVICES

MicroSystem Designer Low cost design debug development tool to evaluate microprocessor based systems Usable either as 8 or 16 bit universal prototype instrument or training aid Currently supports Z80A 8080 8086 8002 future support M6800 8085 8048 M6809 All command data entry formats standard giving same methods of emulating any microprocessor Comprises 14 segment 16 digit alphanumeric display hex input keyboard 16 key command function keyboard 8 user I/O input switches LED output Personality modules specific to each mpu Solderless breadboard area for prototype ccts RS232 link **Engineers Labs**

PLESSEY

New high speed *RAM* for Z80A systems Memory board *model PSM4463/Z* 64 Kbytes RAM addressable £679 single discounts to OEMs distributors **OEMs**

PORTABLE MICROSYSTEMS

Enhancements for *AIM65* 1) *A65/S100* AIM65 to 100 bus conversion bridge to Z80/8080 based products From £132 2) *A65/6800* extension enables Rockwell System 65 Motorola Exorciser other modules employing 6800 bus From £135 3) *A65/KIM*

AIM 65 to KIM-4 Expansion motherboard enabling addition of KIM boards Price from £60 **OEM, Lab** (AIM65)

RAPID RECALL

Two new *DMA controllers* models 8237 *(3MHz) & 8237 2 (5MHz)* Intel products For use with 8085A 8088 micro systems 1.6 Mbytes per second memory to peripheral and reverse using 8237 2 Allows micros to interface directly to hard discs fibre optics etc *Model 8237* block transfers within memory independent of mpu 4 independent DMA channels address increment decrement **OEMs**

Modata
39 St. JOHNS ROAD
TUNBRIDGE WELLS
KENT
Telephone Tunbridge Wells (0892) 41955

DIGITAL MICROSYSTEMS
LOW COST BUSINESS COMPUTERS

DSC 2
ONE [illegible] MEGABYTES DISK STORAGE
64 Kbytes of Main Memory STANDARD
Digital Research CP/M operating system STANDARD
TEXT PROCESSING, BASIC, COBOL, FORTRAN available

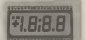
HEX 29
32 to 58 MEGABYTES DISK STORAGE
32 USER & 16 TASK capability STANDARD
Relocatable ASSEMBLER & BASIC STANDARD
Floppy disk based development system available

MODATA [illegible]

BRAND NEWs

RASTRA ELECTORNICS

LCD106 Liquid Crystal Display 3 1/2 digit 1/2 high decimal pts plus/minus CMOS driver Fully decoded Requires single external capacitor to fix backplane signal frequency £5.45 plus VAT **OEM**



Bureaux, Consultancies, Services, Shops

DATA EFFICIENCY

1) *Dust covers for terminals and printers* Available for hundreds of different models High quality flexible vinyl taffeta finish Machine stitched £9.95 2) *Cable protectors.* Tapered edges nonslip fluted base for neat, safe attachment to floor Eight styles and sizes £20.31 Prices exclude VAT Free colour catalogue available **SB MB BB, OEMs**

ELECTRONIC BROKERS

Largest buyer and seller of used systems peripherals in Europe **SB**

LIFEBOAT ASSOCIATES

Software Supermarket (tm) Software for North Star Horizon Vector MZ Ohio Scientific Cromemco Processor Technology Rair Black Box Dynabyte SD Systems Research Machines Altair Exidy Sorcerer Imsai Heath IBM 8 formats Dealers in software from Digital Research Micropro Software Systems GRAFFCOM and others **PU SB**

Keep offices clear of loose cables

Photo of R[illegible]
Prevent [illegible]

Dust Covers for Computer Terminals and Printers from DATA EFFICIENCY LIMITED

PERIPHERAL SUPPLIERS ASSOC

Represents collective interests of independent computer peripheral suppliers trading in UK Association secretary Helen Gibbons

SIA COMPUTER SERVICES

Bureau Pascal computing service using advanced implementation on its CYBERPOWER remote access computer service The Pascal 6000 compiler developed by Federal Institute of Technology Zurich enhanced by University of Minnesota Service includes Pascal library development tools (performance analysers decoders program editing utilities) 110 lines of code per second about 1p per line of code Low memory requirement **MD, BB**

▶

Make your
SORCERER™
work for you

- Mains distribution box
- Completely decoupled safe to use fused
- 3 on/off + 1-32 level dimmer
- 13 amp sockets
- Full documentation supplied, complete with plug
- £69 + VAT includes P & P

hi-tech electronics
1 Richmond Gardens Highfield Southampton SO2 1RY
Telephone 0703 558072

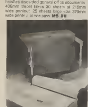
MINE OF
INFORMATION LTD

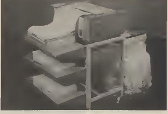
1 FRANCIS AVENUE
ST ALBANS AL3 6BL
ENGLAND
Phone 0727 52801
Telex 925 859

MICROCOMPUTER
CONSULTANCY &
BOOK SELLERS

OFREX LTD
1) *Data file filing system* An extremely tough file built to take the weight of heavy printouts Universal mechanism takes both burst unburst paper £2.33 2) *Desk top chassis* complements Data file to form working unit £19.73 **MB BB** 3) *Shredder model Computershred 1600* High capacity machine shreds bulk computer printouts handles discarded general office documents 406mm throat takes 30 sheets of 210mm wide printout 25 sheets large size 370mm wide printout at one pass **MB BB**

BRAND NEWs





SWAN PACKAGING
New firm new product *Discpac* postal package designed for mailing floppy discs Two sizes 8.75 by 8.75 in for standard discs 6 by 6 in for mini discs Strong white coated corrugated cardboard Supplied flat folds easily and quickly to pack holding up to 6 discs Advises wrapping of discs in metal foil before posting **SB, MB, PU**

WOOTTON, JEFFREYS & PARTNERS
Bureau Offer a commercial statistical and scientific computer service from their Brookwood Woking head office Both timesharing and batch facilities terminals Applications on offer include word processing membership accounting property inquiry standard accounting transport planning survey tabulation road junction design Uses three PRIME 300 systems DEC PDP 11 34 PRIME 400 [illegible] **MB**

Literature

BURR-BROWN
Data sheet on New TM25 Display Terminal Details description applications Manual to come **SB, OEM**

COMPELEC
Leaflet on Instant Software package Colour brochure for Simpelec wordprocessor system (6 pp) **SB**

COMPUTER AND COMMUNICATIONS BUYER
Published by Technology News of America which also supplies American Newsletter to *Computer Age* Service for the industry Inside information projections hard news takes market pulse Monthly Subscription yearly Dollars 125 US & Canada 150 airmail elsewhere **MB BB**

COMPUTER AUTOMATION
Handbook for New Computer Automation Naked Mini Scout 4/04 16 bit processor Fully illustrated Four parts 1) Basic Machine 2) I/O Controllers 3) Software 300 pp £9.75 inc p & p Neil Clements marketing Services Manager **OEMs Labs**

INTEL (UK)
Brochure "Intelligence" Gives brief description of its microcomputers families and most used memory products Main characteristics of each family discussed, brief details of support available 20pp Free Engineers

MICROSENSE COMPUTERS
Brochure on APPLE Computer Systems Gives information on APPLE in business education and learning technical overview Disc 2 Floppy Disc subsystem graphics input tablet telecommunications and printer interfaces expansion options system software business and financial applications documentations PU SB MB

NASHUA
Leaflet guide to formatting disc packs cartridges and diskettes used with Data General computer drives Briefly explains formatting advantages of user created formatting lists formatter programs available New Free

PETFOLIO
Booklet PET for Beginners now into second edition Four chapters 1) Programming cursor control keys 2) Presenting data on screen in chunks 3) Peek and Poke 4) Strings Written by two lecturers at New University of Ulster **PU** (PET)

PRIME COMPUTERS
Primeworld company publication Product information user stories (PRIME)

RAPID RECALL
1) Guide to microcomputer and memory systems and components available from vendor P[illegible] list Eleven sections microcomputer components systems (inc software) memory components hybrid analogue gates low power industrial components industrial products military components peripheral and support components and service Free 96pp **Engineers, OEMs** 2) Inhouse publication "RRT" Bimonthly newsletter stock lists new product details technical design notes general news 3) Pocket guide to Intel OEM computers (single board expansion boards [illegible]

Exhibitions, Courses, Events

COMPUTER AIDED DESIGN EXHIBITION
31 March 2 April Metropole Hotel Brighton

IBM VM/CMS CONFERENCE
19 20 March Sheraton Hotel Frankfurt (ONLINE organised)

VIEWDATA '80 EXHIBITION & CONFERENCE
26 28 March Wembley Conference Centre Wembley Middx

COMMODORE SYSTEMS
1) Courses Basic for Beginners *March 3 5* Skyway Hotel Heathrow **Commodore Disc Programming** *March 6 7* Skyway Hotel Heathrow **Advanced Basic Programming** *March 12 13* Skyway Hotel Heathrow **2) Seminars Microcomputers and the businessman** *March 10* Skyway Heathrow **Microcomputers in control systems,** *March 11* Skyway Heathrow

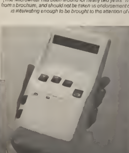
INFOTECH
Technology briefing Computer Appreciation for middle management *26 28 March* London Ref KBB7

LONDON CHAMBER OF COMMERCE
Training courses *12 13 March* Introduction to computers and their applications *18 March* Choosing between a bureau and own computer For middle & senior management

The Microwriter system

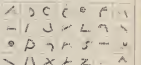
BRAND NEWs

(The Microwriter has been around for nearly two years This information is from a brochure, and should not be taken as endorsement of a product which is interesting enough to be brought to the attention of our readers)



1. Microwriter: The Microwriter is a portable, battery-operated, five-finger machine the size of a medium-sized electronic calculator Words are keyed into the Microwriter where they are displayed on a lighted panel and stored in the large built-in electronic memory One can check the text, correct or edit it delete or insert words or paragraphs The fingering of the Microwriter is ' so simple that anyone can learn to use it in less than half a day ' **2. Automatic Printer·** The Microwriter system is supplied with an automatic high-quality high-speed typing machine When the Microwriter is plugged into it, the printer produces the output at up to ten times the speed of typing It comes out 'perfectly typed and error-free' in the form of a letter or memorandum in single or double-spacing In normal office use one printer can handle the output of up to 10 to 15 Microwriters **3 TV Display** The Microwriter can also be used with a television monitor which enables the writer to see 16 lines of text at a time in the precise format in which it will be printed This 'makes it easy for you to read through your material and to correct or edit it " **3. Cassette Storage:** A small pocket cassette-recorder makes it possible to transfer the contents of the memory on to a micro cassette Enables the keeping of standard paragraphs or letters on micro-cassettes for future reprinting through the Microwriter **Technical specifications Keyboard,** A 5-finger keyboard (with sixth control key) based on a learning system ' offering effective touch-type entry from the first day of use ' **Characters,** Full alpha numeric range, including upper and lower case punctuation and all other normal keyboard symbols **Controls;** The 5-finger-plus control keyboard gives a wide range of controls which make it possible to read or jump forward or backward and offers full instant editing facilities (review correct delete insert words or even paragraphs) **Memory,** 8 000 character (approx 1500 words) Random Access Memory Further storage by micro-cassette **Display,** Alpha numeric L E D with 12 character positions Text scrolls to left Optional TV display for 16-line read-out **Battery;** Rechargeable batteries charger supplied Automatic battery charge warning **Dimensions** 4 ' wide 8½ ' long 2¼' deep (max) Weight 24oz

microwriter Alphabet



Address Bus

[illegible] UK Ltd
[illegible] High Street
[illegible] Malden
[illegible] Tel 01 949 12[illegible]

[illegible] Computer Systems Ltd
[illegible]
[illegible]
[illegible]
Surrey
[illegible] Tel 01 [illegible]

[illegible] Systems Ltd
[illegible] House
[illegible]
[illegible]
[illegible]

Burr [illegible] International Ltd
Cassiobury House
11 [illegible] Station Road
Watford
Herts WD1 1EA
Tlx [illegible]
[illegible] Tel [illegible]

Business [illegible] Ltd
The Pagoda
[illegible]
Borehamwood
Herts [illegible] Tel [illegible]

[illegible]
[illegible] Road
[illegible]
[illegible]
Surrey [illegible]

BRAND NEWs

Peter Chipperfield Trav[illegible]
322 St John Street
London
EC1V 4QH Tel 01 [illegible]

Commodore Information Centre
360 Euston Road
London NW1

Computer and Communications Buyer
26 Broadway
New York
NY 10004

(Computer Automation)
CAI Limited
Hertford House
Maple Cross
Rickmansworth
Herts WD3 2XD
Tlx 922654 Tel Rickmansworth 71211

Compelec Electronics Ltd
14 15 Berners Street
London W1P 3DE
Tlx 8952714
Compel G Tel 01 636 1392

Computermarket
Windmill Street
London W1V 7PA Tel 01-437 4187

Data Efficiency Ltd
Maxted Road
Maylands Avenue
Hemel Hempstead
Herts
Tlx 82554 DATEFF G Tel (0442) 57137

Design & Industries Association
c/o 17 Lawn Crescent
Kew Gardens
Surrey TW9 3NR Tel 01 940 4925

Digital Design & Development (3D)
43 Grafton Way
London W1P 5LA Tel 01 387 7388

Electronic Brokers Ltd
49 53 Pancras Road
London NW1 2QB
Tlx 298694 Tel 01 837 7781

GP Industrial Electronics Ltd
Skardon Works
Skardon Place
North Hill
Plymouth
PL4 8HA Tel Plymouth [illegible]

[illegible] Lane
[illegible]
Wokingham
Berkshire
RG11 5AR Tel [illegible]

Infotech Limited
Nicholson House
Maidenhead
Berkshire SL6 1LD
Tlx 847319 Tel 0628 35101

Intel Corporation (UK) Ltd
Dorcan House
Eldene Drive
Swindon
Wiltshire SN3 3TU
Tlx 444447 INT SWN (0793) 26101

KGM Electronics Group
Clock Tower Road
Isleworth
Middlesex TW7 6DU
Tlx 934120 Tel 01 568 0151 6

Keen Computers Ltd
5b The Poultry
Nottingham
Tlx 37297 Tel (0602) 583254 5 6

Lifeboat Associates
32 Neal Street
London WC2H 9PS Tel 01 379 7931

Lightning Elimination Associates Ltd
Vine Cottage
Moreton
Thame
Oxon Tel Thame (STD 084 421) 3204

London Chamber of Commerce
& Industry
69 Cannon Street
London EC4N 5AB

MSS House
49 Chapel Road
Worthing
West Sussex
BN11 1EG Tel (0903) 34755 [illegible]

Mektronic Consultants
Linden House
176 Factory Lane
Prestwich
Manchester M25 5QB
Tlx 666387
ATT MEKTRONIC Tel 061 798 0803

[illegible] Computers Ltd
Finway Road
Hemel Hempstead
Herts HP2 7PS
Tlx [illegible]
DATEFF G Tel [illegible]

Microwriter
7 Old Park Lane
London [illegible] Tel 01 493 [illegible]

Micro [illegible] Business Systems Ltd
[illegible] Chapel Lane
Yeadon
Leeds LS19 7NX
Tel Rawdon (STD 0532) [illegible]

Nashua Computer Products
Cory House
Bracknell
Berkshire
RG12 1ET Bracknell (0344) [illegible]

On Line Conferences Ltd
Cleveland Road
Uxbridge UB8 2DD
Tlx 261173 Tel (0895) [illegible]

Orex House
Stephen Street
London W1A 1EA Tel 01 [illegible]

Package Programs Ltd
91 Blackfriars Road
London SE1 8HW
Tlx 888724 Tel 01 [illegible]

Penny & Giles Data Recorders Ltd
Computer Peripherals Division
Mudeford
Christchurch
Dorset
BH23 4AT Tel (042 52) [illegible]

Peripheral Suppliers Association
Owles Hall
Buntingford
Herts
SG9 9PL Tel Royston (0763) 71[illegible]

Petfolio
Imsberg
Blackhill
Coleraine
N Ireland BT51 4EU

Plessey Microsystems Limited
Water Lane
Towcester
Northants NN12 7JN
Tlx 31628 Tel (0327) [illegible]

[illegible]

[illegible] Ltd
[illegible] Belgrave [illegible]
London SW1W 0NY
Tlx [illegible]

South West Universities
Regional Computer [illegible]
University of Bath
Claverton Down
Bath
BA2 7AY Tel Bath [illegible]

Swan
5 Design and Print
[illegible]
London
N7 8Q Tel 01-609 1[illegible]

Tradata Ltd
Tradata House
Hatfield Road
Slough
Berkshire SL1 1QR

Vermont Research Ltd
Cleeve Road
Leatherhead
Surrey
KT22 7NB
Tlx 23280 Tel Leatherhead [illegible]

Wootton Jeffreys and Partners
Cemetery Pales
Brookwood
Woking
Surrey Tel [illegible]

The Rohan Computing Collection.....

Qume CIFER digital OKI

Sprint 5/45
A superb quality daisy wheel printer/terminal. Ideal for general use and word processing.

Microcomputer & VDU's
The most legible screens on the market
VT52 & protected fields.

LA 34/36 LA 120
VT 100/PDT
11/03 – 11/23
CAP Microbol, accounts etc.

The smallest and quietest desk top printer available.
The line matrix printer offering quality, reliability and superb performance.

Rohan Computing

Rohan Computing Ltd., 52 Coventry St., Southam Warwickshire CV33 0EP. Tel: Southam (092681) 4045/Coventry (0203) 56877

IN ESSENCE THE BEST IN INTEGRATED CIRCUIT TECHNOLOGY

The ALTOS Sun Series ACS 8000 BUSINESS/SCIENTIFIC micro computer creates a new standard in quality and reliability in high technology micro computers

High Technology

The ACS 8000 is a single board, Z80 disc based micro computer It utilises the ultra reliable Shugart 8 inch IBM compatible disc drives double density – single sided and providing 1 M byte of data storage The ACS 8000 features the ultimate in high technology hardware a fast 4 MHz Z80CPU 64 kilobytes of 16 K dynamic RAM, 1 kilobyte of 2708 EPROM an AMD 9511 floating point processor (OPTIONAL) a Western Digital floppy disc controller a Z80 direct memory access (OPTIONAL) Z80 parallel and serial I/O (two serial RS232 ports 1 parallel port) and a Z80 CTC Programmable Counter/Timer (real time clock) In essence the best in integrated circuit technology

Built-in Reliability

The ACS 8000 is a true single board micro computer This makes it extremely reliable and maintainable The board and two Shugart drives are easily accessible and can be removed in less than ten minutes All electronics are socketed for quick replacement Complete diagnostic utility software for drives and memory is provided

Quality Software

Unlimited versatility The ACS 8000 supports the widely accepted CP/M disc operating system plus basic (Microsoft and CBasic) Cobol Pascal and Fortran IV All available now

Logitek in conjunction with its own microsoftware house Interface Software Ltd of Camberley is able to supply a wide range of proven off the shelf business software including general accounting word processing, stock control mailing list etc

There are already over 1000 micro computer installations using this software
A track record which we consider speaks for itself

Why 're-invent the wheel' when there is standard software of this quality available now?

ALTOS
SUN-SERIES 8000
LOGITEK

Hard Disk/ Multi User Systems

The Winchester hard disk single and multi user ALTOS systems are now available supporting from 1 to 4 users and providing up to 58 Megabytes of data storage capacity The systems are truly flexible and allow the ALTOS floppy disc system to be expanded to keep pace with the users requirements

Availability

Logitek carry deep shelf stocks of ALTOS hardware and compatible peripherals

If you are a dealer who may be interested in promoting ALTOS and/or Interface Software by joining the fast growing network of approved suppliers contact Logitek

We can offer you something rather special now

Approved Suppliers

LONDON
Logic Bus Ltd
Tel (01) 222 1122

Boyd Microsystems
(Watford)
Tel (01) 950 0303

GLASGOW
Robox
Tel (041) 221 5401
Ashdown Consultancy Services
Tel (041) 641 7758

BIRMINGHAM
Saba Computer Systems
Tel (021) 943 2821

University of Birmingham
(Tony Creswell)
Tel (021) 472 1301
ext 2905/2270

SHEFFIELD
Sheffield Computer Centre
Tel (0742) 53618

GLOUCESTERSHIRE
Woolhack Computer Centre (Tetbury)
Tel (0666) 383

DARLINGTON
Vale Consultancy
Tel (0325) 67766

WILTSHIRE
Val data Services (Melksham)
Tel (0225) 706957

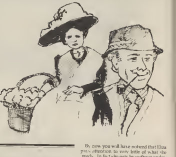
BOLTON
E & S Consultants
Tel (0204) 28644

LOGITEK

Logitek
E I C Electronics Ltd
All enquiries to
Portland St Chorley, Lancs
Tel 02572 66803

also at
30 Kelvin Ave
Hillington Industrial Estate,
Glasgow G52 4LH
Telex 777255

COMPUTERS AND EVERYDAY LANGUAGE



Bill Black lectures in Computer Science at Teesside Polytechnic He became interested in the computer understanding of language while studying Linguistics at university After a period of teaching Liberal Studies in further education he worked on a research project into the application of natural language understanding to information retrieval

'Some developments are by their nature more capable of capturing the imagination than others'

For many years now, science fiction stories featuring computers have depicted them understanding and responding to somewhat diminished human heroes in fluent and natural speech More recently, microprocessor devices can be bought for a few hundreds or even tens of pounds to articulate chess moves or pronounce spellings

The man in the street could be forgiven for believing that the generation of computers with the capabilities of HAL or ORAC is just around the corner

Much has been achieved in the past decade or so, but computer scientists still have a long way to go before they can program computers to display the same kind of intelligence that ordinary people show in their everyday use of language

For a number of years now, there have been a number of programs which converse so well that they have been taken for people That is not to say that the people they fooled have been more gullible than most — after all people can communicate with each other through teleprinters as well as with computers

One program which can do this has been named 'Eliza by its author Joseph Weizenbaum Actually there are probably hundreds of Elizas at many different computer installations some just straight copies of the original and other which respond in slightly different ways A conversation with one Eliza went like this

```
i thought you might be able to help me
GO ON
I have this problem. It's about my car
YOUR CAR
My wife says i've formed an emotional at
tachment to it.
DOES THIS MEAN VERY MUCH TO YOU?
Not really I can t see what she s getting at.
WHY DO YOU SAY YOU CAN'T SEE WHAT
SHE S GETTING AT
You don t understand a thing do you?
WHY DO YOU ASK?
Are you a shrink or aren't you?
TELL ME MORE ABOUT YOUR CAR
```

Just how unintelligent Eliza is can be seen by what happens if she has to respond to badly spelt or ungrammatical input

```
You dont lissun tu a wuhd i say
WHY DO YOU SAY i DONT LISSUN TU A
WURD YOU SAY?
```

And even with no mistakes by the interlocutor, Eliza's slip shows quite clearly in response to some kinds of sentence

```
Are you really you or just a machine?
WHAT DO YOU MEAN, AM I REALLY I
OR JUST A MACHINE?
```

By now you will have noticed that Eliza pays attention to very little of what she reads In fact she gets by without understanding what she is being told at all. The program looks into lines of input only for a small and fixed number of words, like personal pronouns which play an important part in dialogue It is thus possible to ignore the complexity of the structures and rules underlying serious uses of natural language

When looking at how people do use language to pass information rather than to pass the time, it quickly becomes apparent that understanding involves a whole range of levels of decoding and a far from straightforward relationship between them At one end we have to use our perceptual abilities to impose a division of the continuous (analogue if you like) flow of incoming sound into the discrete units our language recognizes At the other we have to relate what we hear to our existing knowledge and attitudes, uncover the logic of the speaker s arguments and the assumptions he makes about our shared understanding and beliefs In between comes the arrangement of sounds or letters into words, and words into phrases and sentences and the construction of the meaning of sentences from the words used and the structures connecting them At each of these linguistic levels there are pitfalls to machine understanding

In any new field of technology some developments are by their nature more capable of capturing the imagination than others In the area of computer understanding of natural language systems which can accept voice input will undoubtedly have this quality, when they are reliably achieved

An enormous amount of money and effort has been poured into research into speech understanding systems, but thus far without success outside of very limited applications. Why should this be so when the *production* of synthetic speech has got to the stage where it can be incorporated in devices that sell for a few pounds?

The answer lies in the difference between the process of producing speech and that of understanding it. Consider a microprocessor driven device which generates synthetic speech. Every time it says the same thing, the sounds produced will be exactly the same. Ask any person to say the same thing repeatedly and it will be slightly different each time. Ask a number of people to say it and the differences will be immediately obvious. To take two extreme examples, a person from the south of England might pronounce 'hay' as a northerner or a Scotsman would say 'high', and a Geordie's 'card' might sound like a Scotsman saying 'cod'. The best computer speech understanders can respond to a limited number of speakers only, and for each of these it has to be individually tuned. When human speakers listen to people with unfamiliar accents, they take advantage of their knowledge that such differences are systematic to break the phonological code of the accent with the aid of clues from the meaning of what the speaker is saying.

Even this is a tall order for a computer, but there is more variability still in the physical quality of speech sounds. When we pronounce the same word in different parts of a sentence, or the same sound in different parts of a word, the physical quality of the sound can vary enormously. Particularly frustrating to the systems designer is the fact that small but important words like prepositions are usually unstressed and in consequence virtually indistinguishable one from another. All of these variations are capable of description, but the manner of that description does not easily generate mechanical procedures. Differences in pitch, stress or vowel quality are described relative to the qualities of sound to which they contrast, and physical thresholds are difficult to define.

Twenty years or so ago linguists appear to have assumed that language processing by humans proceeded in a hierarchical fashion through the linguistic levels, with sounds being processed first, then words identified, sentences parsed and meaning finally interpreted. It has now become clear that it is vitally important to both computer and human understanding of speech that predictions based on the 'higher' levels of processing aid perception of what is actually heard.

Most workers in the field acknowledge that there is still some scope for improvement in systems which treat speech understanding as a signal processing problem, but for longer-term progress to general-purpose voice input, systems will need to incorporate the other levels of the understanding process.

In the nineteen fifties Noam Chomsky gave a great impetus to the study of the structure of languages, which reached into computer science as well as linguistics. The new approach to describing the grammar of languages — both natural and artificial — was to capture the regularities of language use as a system of formal rules which provided criteria for determining whether a given sentence was grammatical or not.

One type of grammatical rule — context-free — describes the hierarchical — or 'phrase-structure' — which accounts for a large part of the grammar of most languages, both natural and artificial.

Examples of context free rules applied to a small part of English are:

sentence → noun_phrase verb_phrase
noun_ phrase → (article) (adjective)* noun
verb_phrase → {intransitive_verb / transitive_verb noun_phrase}

Brackets denote optional constituents, braces that one or other must be selected, and the asterisk that the preceding constituent may be repeated.

In the case of programming languages the syntax is to be found at the back of the reference manuals, specified in a notation which is equivalent to this but which differs slightly from language to language. (see manuals on Algol60, COBOL and PASCAL for different ways of doing the same thing.)

'Chomsky proposed that natural languages use another kind of rule.'

An interesting feature of these rules (and this applies both to natural and programming languages) is that by allowing for iteration and recursion of structures and constituents, a small finite set of rules allows for a theoretically infinite number of utterances in the language.

In the case of programming languages syntax directed analysis or *parsing* has been possible using well defined algorithmic procedures since quite soon after Chomsky's system of rules; the related Backus Naur form for programming languages were developed.

Natural languages have a number of features which don't allow them to be treated in this way.

In the first place they have a number of structures which don't fit into the context free pattern. If you look at the example rules above you'll notice that on the left hand side of each rule there is only one item. This means that only tree structures can be described by context-free rules. A very common feature of natural languages is that agreement is required between constituents of noun and verb phrases, eg:

the dog barks
the dogs bark

To show how number affects the endings of nouns and verbs we could add to our phrase structure rules the following:

noun {singular noun / plural noun}
verb {singular verb / plural verb}

But we have no way of showing that if the singular option is taken in the case of the noun, then it must also be taken for the verb.

A second important feature of natural languages is that they allow different ways of saying the same thing — paraphrases. The relationship between active and passive sentences is of this type (although there are slight shifts in emphasis resulting from the choice made). This in itself doesn't create problems of a purely syntactic nature — we can have separate rules allowing for active and passive verbs. But we have to bear in mind what our analysis is *for*. The reason we do syntactic analysis is to help determine the *meaning* of sentences heard or read. We should thus be able to recognize that

NOUN1 active verb NOUN2 *is equivalent to*
NOUN2 is a passive verb by NOUN1

In consequence of both of these features Chomsky proposed that natural languages use another kind of rule besides phrase-structure rules. Because these 'transformational' rules are in a sense more liberal than phrase structure rules, it is more difficult to apply them to mechanical understanding of language. Nevertheless a working computer based system has been created, using the transformational approach, by Stanley Petrick and his co-researchers at IBM. The system is used to allow computer-naive managers to query the contents of a database, a common application of systems which are capable of a limited degree of understanding of natural language.

A third and most intractable problem of natural languages is their *ambiguity*. In programming languages this is simply not allowed. In natural languages ambiguity is a problem at all levels. We have already met cases at the phonological level where the same physical sound can have different values in the language according to the speaker and circumstance.

At the level of syntax, one type of ambiguity is that which arises because many words can interchangeably play the part of nouns, adjectives and verbs. In some structures this is shown by word endings, but in many cases it is not. To take just examples from the previous sentence, 'many', 'structure', 'ending', 'case' can all be members of different parts of speech.

A particularly common structure in technical writing occurs when nouns are employed to modify other nouns, ie they are acting in the role of adjective. Examples are noun phrase, syntax analysis, clock timer, bit slice, database system, end user interface and so on.

Since natural language expressions can have multiple syntactic roles, the process of analysing them by compiler-like techniques involves at the very least more backtracking, when a wrong guess has been made about the role of a particular word, than occurs in the parsing of programming languages. At the worst, combinations with other parts of the sentence will not work out to reduce the possible roles of each word to one, and an ambiguous structure remains with two or more readings like those in Chomsky's well-known example

flying planes can be dangerous

The analysis of meaning by computer

So far, we've met ambiguity in natural language with reference to the levels of sound and grammar. The examples given so far could have been more convincing, but I was trying to avoid sentences whose ambiguity depended on the use of words with two or more wholly different meanings. In "flying planes", the two readings can be dismissed as meaning the same thing, but differing in focus, in the one case on the fact that planes constitute a danger to some unspecified person, and in the other on the danger to the person doing the flying. An even shorter ambiguous sentence (this time taken from a linguistics textbook by Professor John Lyons)

they can fish

is both syntactically and semantically ambiguous. It has two separate syntactic analyses (See Fig. 1).

At the same time, the word can has two completely separate meanings — the activity of putting things into cans and the sense of being able to do something — as well as two separate syntactic roles.

Like flying planes, the sentence above is genuinely ambiguous. Sentences such as these can be the source of a great deal of humour, and of course they present computers with a bit of a problem. However, the problem is not substantially less in the case of normal unambiguous sentences. Most of the content words used frequently have more than one meaning or sense. For example, I recently bought a pair of *boots* to *fit* to the steering *rack* of my *car*. In the previous sentence, all of the words underlined have other senses which could be used in other contexts. A computer program which retrieved the meanings of these words would find that boots could be items of footwear, two completely different parts of a car, or a colloquial verb, fit could describe a state of health as well as an action, and so on. The possible senses of the sentence as a whole, however, do not add up to the product of the senses of all the ambiguous words in it: there is only one sensible reading of this sentence and in this context the words used no longer have any ambiguity. What a machine has to do in order to analyse the meaning of such a sentence is to have access to a dictionary of information about words which is organized in such a way as to show what sorts of actions can happen to given objects, what sorts of actions those objects are capable of, and so on. With this sort of information it is possible to *prefer* one sense of a word over others in a given context, and the further the text is processed, the less room for uncertainty about the intended meaning of a word remains. In fact, it is possible to use this information to simplify the syntactic aspects of analysis as well.

The great disadvantage in systems which use semantic information in this way is that there is simply so much of it. When you think about it, human understanding relies on a body of knowledge and experience built up over a lifetime, and it is obviously a major undertaking to create computers which understand to the same degree.

So what computer scientists usually do is to create systems which display understanding in a limited domain of experience. Of these, perhaps the best known are Winograd's SHRDLU, Schank's MARGIE and SAM, and Woods' LUNAR. Their areas of expertise are, respectively, a world of toy blocks (and all their physical properties which affect the way they can be manipulated), simple stories, and a database of information about the analysis of lunar rock samples. The programs created by Schank and his associates are a part of a long-term effort at creating a general psychologically plausible model of human comprehension, but the others, as well as much of the present research effort, are concerned with applications which can be tackled with some degree of success in our present state of knowledge.

The next article in this occasional series will look in more detail at how natural language understanding has been applied to database systems to make their contents more accessible to non programmers, and a later article will introduce some limited experiments in parsing and semantic analysis that can be carried out on a small scale. ■

Editor's Note: At the risk of perpetrating a terrible pun, I wonder if Professor Weizenbaum named his conversational program Eliza because he wanted to hint that it actually could do [illegible]

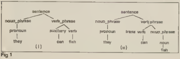


Fig 1

Try the ACT 800 series computer at one of these dealers now:

LONDON
Lion House (Retail) Ltd.
227 Tottenham Court Road, London W1P 0HX
Tel: 01 580 7383

THE SOUTH
Pamisol Electronic Services
32 Chertsey Road, Woking, Surrey
Tel: 04862 61778/23817

Bus Rate Electronics
Rownhams House, Rownhams, Southampton
Tel: 0703 7348 [illegible]

RUF Computers
System House, Victoria Way, Burgess Hill, W. Sussex
Tel: 04446-46811

T & V Johnson (Microcomputers) Ltd.
165 London Road, Camberley, Surrey
Tel: 0276-62506

South East Computers Ltd.
4 Castle Street, Hastings, Sussex
Tel: 0424-440000

HSV Business Systems Ltd
May Place, Basingstoke, Hants RG21 1NX
Tel: 0256 69444
Southampton Street, Southampton, Hants
Tel: 0703 22131

Wilson Hughes and Partners (Data Sciences) Ltd
16 Chequers Square, Uxbridge, Heathrow UB8 1UN
Tel: Uxbridge 58308

The Accounting House Ltd.
54 London Road, Morden, Surrey SM4 5BA
Tel: 01 640 833
Thyssen Rheinstahl House
Molly Millars Lane, Wokingham, Berkshire RG11 1PU
Tel: Wokingham 783434
52 High Street, Chatham, Kent ME4 4DS
Tel: Medway 4867 [illegible]

SOUTH EAST
Sonodeck Ltd
34-36 St Helens Road, Westcliff-on-Sea, Essex
Tel: 0702 338580

The Computerist (Pronole Ltd.)
642 London Road
Westcliff-on-Sea
Essex
Tel: 0702 336386

SOUTH WEST
ACT Bristol Ltd.
Graphic House, Telephone Avenue, Bristol BS1 4BS
Tel: 0272 211733

EAST MIDLANDS
HB Computers
22 Newland Street, Kettering, Northants
Tel: 0536 520910/83322

Lowe Electronics Ltd
Chesterfield Road, Matlock, Derbyshire DE4 3HE
Tel: 0629 2817/2430

Arden Data Processing Ltd.
Milton House, Bowling Green Street, Leicester
Tel: 0533 22255

Office Computer Techniques (Midelectron)
Highcroft, Husbands Bosworth, Lutterworth, Leics

NMS (Stanmoor) Ltd
26 Mill Street, Bedford, Beds
Tel: 0234 40601

Castle Computer Systems
72-74 Trinity Lane, Hinckley, Leics
Tel: 0455 613544

A.J.R. (Office Equipment) Ltd
5 Church Drive, Daybrook, Nottingham NG5 6JP
Tel: 0602 208047

Hallam Computer Systems
Berkeley Precinct, 451 Ecclesall Road
Sheffield S11 8PN
Tel: 0742 663 95

EAST ANGLIA
Sumlock Electron (East Anglia) Ltd
Leicester House, 32 Prince of Wales Road
Norwich, Norfolk
Tel: 0603 25258

WEST MIDLANDS
Taylor Wilson Systems Ltd
Oakfield House, Station Road, Dorridge
W. Midlands B93 8HQ
Tel: 021 564 4182

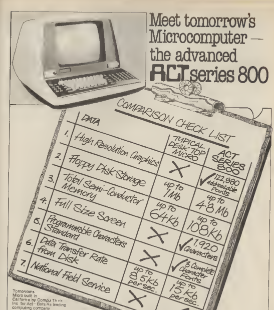
MERSEYSIDE
Stelab Computer Services Ltd
289-293 Derby Road, Bootle, Merseyside L20 8LN
Tel: 051 933 5511

D.A.M.S. (Office Equipment) Ltd
30-36 Dale Street, Liverpool 2
Tel: 051 227 330

Aughton Automation Ltd.
Westwood Road, Kirby, Liverpool
Tel: 051 548 9080

MANCHESTER
Cytek U.K. Ltd.
12 Exchange Hall, Corn Exchange Building
Manchester M4 3EY
Tel: 061-832 7604

SCOTLAND
Rivoss Office Equipment Ltd
Unit 16, Anderston Shopping Centre, Argyll Street
Glasgow G2 7PH
Tel: 041 221 5401



Meet tomorrow's Microcomputer — the advanced ACT series 800

COMPARISON CHECK LIST

	DATA	TYPICAL DESK TOP MICRO	ACT SERIES 800
1.	High Resolution Graphics	✗	✓ 122,880 addressable Points
2.	Floppy Disk Storage	up to 1Mb	up to 4.8 Mb
3.	Total Semi-Conductor Memory	up to 64Kb	up to 108Kb
4.	Full Size Screen	✗	✓ 1,920 characters
5.	Programmable Characters Standard	✗	✓ 3 Complete Character Fonts
6.	Data Transfer Rate from Disk	up to 8.5Kb per sec.	up to 15Kb per sec.
7.	National Field Service	✗	✓

Tomorrows
Micro built in
California by Compu Think
Inc. for Act – Britain's leading
computing company

ACT SYSTEM 808—800Kb of disk storage
£3 950 + VAT
ACT SYSTEM 824—2 4Mb of disk storage
£4,950 + VAT

Complete business systems incorporating the Series 800 with Centronics Printers and ACT's own Powerful Nabula 2 Software are also available. Prices correct at time of going to press.

£19·45p.w.*

*5 year lease. Shorter terms available

ACT series 800 Complete the coupon for full details and the name of your nearest dealer who can arrange an immediate demonstration

My Name ______________________

My Address ______________________

______________________ Tel ________

ACT MICROSYSTEMS

Total Computing

Radclyffe House
66-68 Hagley Road
Edgbaston
Birmingham B16 8PF
Tel 021-455 8686
Telex 339396

A simple introduction for beginners

ON AND OFF

After discussing the merits of the Binary System in the previous two articles (in issues 2 and 3), let us further expand on the properties of devices which can assume one of two possible positions (states). An electric switch is such a device for it can assume only one of two states: on or off. Another example is the transistor if we allow it to operate in the saturation or cut off regions with the ability to switch it from one to the other.

The two distinct states in the examples mentioned above and others are referred to sometimes as "on" and "off", "true" and "false", "1" and "0" etc. Which pair of these terms is chosen depends to a large extent on the nature of the device and on the application. Thus when we talk about an electric switch we normally use the terms "on" and "off"; when we talk about a statement like "the sky is blue" or "the sea is red" we tend to use "true" and "false" and when we talk about the contents of a memory element which can assume only one of two states we normally use "1" and "0".

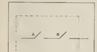


Fig 1

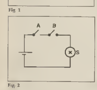


Fig 2

Now, if we build a network of switches like the one in Fig 1 and look at the network as a whole, we would like to be able to talk about its state as if it were a "black box". To illustrate this let us add to this network a bulb and a battery (Fig 2) and make the following assumptions:

1) If a switch (A or B) is on — its state will be true; if the switch is off — false.
2) If the bulb S is on — true; if the bulb is off — false. Thus the bulb will be on ("true") only if both switches are on ("true").

Here we have introduced a relation between the states of the switches and that of the bulb. This relation is written as

$$S = A \text{ AND } B, \text{ or } S = A \cdot B \text{ or } S = AB \quad (1)$$

and it means that S is true only if both A and B are true; it follows that S is false if A is false or B is false. It is sometimes convenient to express this relationship in a "truth table" form like the one in Fig 3.

A	B	S
T	T	T
T	F	F
F	T	F
F	F	F

Fig 3

The relation expressed in equation (1) and fig 3 is known as an "AND" operation and it is one of the most fundamental relations in Boolean Algebra — named after the English mathematician George Boole (1815–1864) — which deals in general in relations (operations) concerning variables which assume one of two values.

The AND operation need not only concern two variables (A and B) but can be expanded to any number of variables:

$$S = ABC \ldots Z \quad (2)$$

Equation (2) which reads S equals A and B and C etc means that S is true only if A and B and C ... and Z are all true. Any one of the A to Z being false renders Z false.

Another fundamental relation in Boolean Algebra is the OR operation. This operation could also be illustrated by the use of switches (Fig 4).

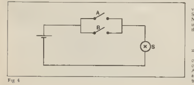


Fig 4

Here S is true if either A is true or B is true; here S is false if both A and B are false. This relation is written as

$$S = A \text{ OR } B \text{ or } S = A + B \quad (3)$$

As with the AND operation, equation (3) could also be expressed in truth table form (Fig 5).

A	B	S
T	T	T
T	F	T
F	T	T
F	F	F

Fig 5

The OR operation, like the AND, could be expanded to several variables:

$$S = A + B + C + \ldots + Z \quad (4)$$

Here, S is true if any, some or all the variables A, B, C, ... Z is (are) true and S is false only if all A, B, C, ... Z are false. Now it is possible to have functions which involve both AND and OR operations like the one illustrated in Fig 6.

Here $S = (A + B)CD$ (5)

The interpretation of the brackets is identical to the one used in school algebra.

In general, any combination of switches connected in series and (or) in parallel could be expressed as a function involving AND and (or) OR operations. But, what about a switch which is automatically turned *off* if another switch is turned on and is automatically turned on if the same switch is turned off? Let us call this switch $\bar{A}$ and call the original switch A. Thus the truth table which describes their mutual behaviour is the one illustrated in Fig 7

A	$\bar{A}$
T	F
F	T

Fig 7

The relation between A and $\bar{A}$ is known as negation and it means that if A is true then $\bar{A}$ is false and vice versa

To illustrate the negation operation, let us look at the function S in equation (6) — read as S equals A AND NOT B Here S is true only if A is true and $\bar{B}$ is true or if A is true and B is false

$$S = A\bar{B} \qquad (6)$$

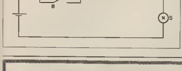
A further illustration of the use of negation let us define a new operation Exclusive OR and give it the symbol ⊕ This function is defined as in Fig 8

A	B	S
T	T	F
T	F	T
F	T	T
F	F	F

Fig 8

This function written as

$$S = A \oplus B \qquad (7)$$



indicates that S is true if A is true exclusively, ie, S is false if both A and B are true or if both are false The reader can try to express this function using AND and OR operations only but I am certain he will not succeed. He will however be able to verify that equation (7) could also be written as

$$S = A\bar{B} + \bar{A}B \qquad (8)$$

Two very useful relations between AND, OR and NOT operation are the De Morgan equations (9) and (10)

$$\overline{AB} = \bar{A} + \bar{B} \qquad (9)$$

$$\overline{A + B} = \bar{A}\bar{B} \qquad (10)$$

The first equation states that if (A AND B) is not true then A is not true or B is not true or putting it in terms of switches if both switches A and B are not on then either switch A is not on or switch B is not on or if the statement A and B is false then A is false or B is false

The second equation states that if (A OR B) is not true then A is not true and B is not true, or if neither switch (A or B) is on then switch A is not on and switch B is not on or if the statement A or B is false then A is false and B is false

These two equations which could be expanded to any number of variables, are extensively used by designers of switching circuits in order to simplify switching functions However, we shall not dwell on them or on any other methods they use in this brief description of switching (logic) ideas ■

LET'S TALK SENSIBLE PRICES

ALTOS Sun Series 800

One of the most sophisticated and reliable microcomputers available

Measures only 17 5 x 7 25 x 18 5 Inches

Here are some examples of our prices

HARDWARE

Z80 4MHZ single board computer
1K ROM
64K RAM
2 x Double Density Shugart 8 inch drives
2 x Serial I/O
1 x Parallel I/O

PRICE £2768

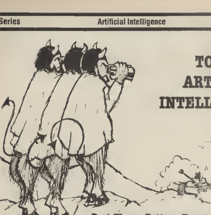
Double Sided/Double Density drives also available Dealer Discounts available

SOFTWARE

CP/M	100
OASIS	300
CBASIC II	90
MBASIC Interpreter	210
MBASIC Compiler	210
Fortran-80	300
Cobol-80	450
Pascal 8	120
APL/Z80	210
Z80 Macro Assembler	60
Pascal Word Processor	450
WordStar	255

COLIN BENTLEY ASSOCIATES LTD
4A Clock House London Road Waterlooville Hants PO7 7EZ (07014) 51082

TOPICS IN ARTIFICIAL INTELLIGENCE



Part Three: Pattern Recognition

This is the third [illegible] Dr Fairhurst is at the Electronics Laboratories [illegible] the University of Kent at Canterbury. Readers who are doing practical work in artificial intelligence are invited to write to the Editor.

What is pattern recognition?

Although you may not be explicitly aware of the fact as you read these words you — the reader — are carrying out an operation of the greatest complexity involving an enormous amount of neural computation. In fact you are manifesting one of the most powerful and useful attributes of human intelligence — a facility for pattern recognition.

A moment's thought will demonstrate that the reading process requires a number of recognition tasks to be accomplished. The marks made in ink on the paper must be identified as meaningful in relation to past experience. This means recognising not only that A and B are different letters but that AND say is a valid word while PQD is not. At an even higher level a word you read must be recognised in the sense that it conveys a particular concept or performs a specific grammatical function which facilitates the transmission of information from me, the writer, to you, the reader.

In everyday life pattern recognition tasks encompass a very wide range of activities which impinge upon practically every [illegible] our. We hear [illegible] speech [illegible] normal speech [illegible] Mozart symphony [illegible] sound of a boiling kettle [illegible]. We can even identify different speakers and note those slight [illegible] anger, surprise [illegible] and distinguish between [illegible] unfamiliar handwriting [illegible] between a Mercedes and a Mini [illegible] the symptoms [illegible] human [illegible] processes [illegible] play as [illegible] a poet or composer [illegible] the familiar plot of a novel or a way of solving a particularly knotty problem.

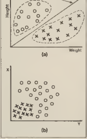


Fig 1

Of course not all the problems tackled under the heading of pattern recognition are [illegible] everyday tasks by all human beings. For example identifying a particular form of heart disease or recognising the [illegible] Ronald Biggs are highly specialised tasks which may only be undertaken by skilled personnel. Nevertheless the [illegible] recognition tasks which [illegible] for investigation with a view [illegible] automation.

It is almost inconceivable then that our lives as intelligent organisms could be carried out without an ability in pattern recognition and for this reason it set [illegible] which fall within the bounds of artificial Intelligence. We shall consider some specific aspects of machine [illegible] in later articles and concentrate [illegible] on the general problems of pattern recognition, introducing some of the simplest techniques for the implementation of a pattern recognition system.

By way of an introductory example let us consider the problem of how to distinguish between a man and a woman. There are clearly many ways in which this problem may be tackled! However for the purposes of illustrating a pattern recognition technique let us confine ourselves to dealing with parameters which can be measured with minimum embarrassment.

A good starting point might be to look at the height weight relationship for men and women. Figure 1 (a) shows a graph of height against weight for a typical sample of men and women, where men are denoted by the [illegible] points and women by the [illegible] points. We can learn a number of things from this graph.

First, we can draw the general conclusion that the points on the graph corresponding to the two possible categories form groups (indicated by the dotted lines) which are distinct. Even allowing that if we were to consider more samples the two groups of points might become less distinct and perhaps even overlap to some extent the distinguishability of the two classes should still be substantially preserved.

Second, if we wished to define a recognition rule for the two groups, we could do this easily by drawing a boundary between the two groups of points. In Figure 1(b) this can take the form of a straight line as shown. Such a decision [illegible] can be used to formulate a classification rule by [illegible] this line a [illegible] point falls. In the example considered we found that a simple straight line [illegible] but in a more complex [illegible] function might [illegible] Consider as an example [illegible] shown in Figure [illegible] suitable discriminant [illegible]

The [illegible] considering [illegible] the important aspects of pattern recognition. For example, it is clear that the graph can only be drawn in the first place on the basis of making specific measurements on the pattern groups to be identified. Here we chose height and weight and, judging by our results, these parameters seem to be a reasonable choice for this fairly simple task. Such identifiable parameters are normally referred to as *features* of a pattern class and the choice of features to use in a particular situation can be crucial to the successful design of a pattern recognition system. How successful should we have been, for example, if we had chosen as parameters for the above task length of hair and number of teeth?

It should also be noted that, in more complex tasks a larger number of features would be needed in order to make a recognition decision. The problem must then be represented in a higher dimensional feature space (hyperspace), and the discriminant function (hypersurface) would then generally assume a relatively complex mathematical form rather than the simple straight line form of our example. (You should however be able quite easily to extend this principle to feature space in three dimensions.)

Finally we may note another interesting fact. On the basis of the measurements taken for our simple experiment it is possible to identify (by means of observing the *clustering* of points into two regions) the presence of two potentially distinct pattern classes, even if we are not able to attach labels to them.

In order to assign points to named categories, however, a requirement is that we are given named and labelled examples of the classes we must identify. Such a procedure might be considered analogous to the process of *learning* a desired classification.

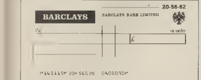


Fig2

Let us now consider briefly a second and perhaps more realistic problem in pattern recognition. Figure 2 shows a typical format for a bank cheque in common circulation. The bottom line contains a row of printed numbers usually giving information relating to such items as the issuing bank's *sorting code*, the *number* of the cheque and the customer's *account number*. How might we begin to automate cheque handling by making a machine read and recognise this numerical data?

One simple approach is to define a mask or *template* for each character which may occur. In trying to identify an unknown character we may then test it against each one of the masks in turn until we find a match. The character is then assigned to the category defined by the matching mask. In Figure 3, for example, the test character could be best accommodated by the 3-mask, allowing its identification as a '3'.

It should be clear that this matching technique can only be really successful if the character set to be identified is very well-defined and closely controlled. The numbers in the character set for cheque information are seen to be highly stylised and reproducible and are indeed deliberately designed to exaggerate differences among the pattern classes. However, such a restricted technique would not be particularly useful if a system was required to read characters typed by any ordinary typewriter or handwritten versions of the numerals. In order to tackle such wide-ranging (and potentially much more useful) tasks, therefore, we need a more flexible technique.

A more general and flexible scheme can be introduced by means of an abstract model of a possible pattern recognition procedure, and one which forms the basis of a number of practical systems. This model, known as the PANDEMONIUM scheme, is illustrated in Figure 4. In this scheme the pattern recognition process is broken down into a number of stages, with the processing at each stage carried out by 'mythical' demons, whose functions are fairly precisely defined. The PANDEMONIUM scheme operates along the following lines:

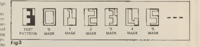


Fig3

- *Stage 1* The first stage of processing is carried out by **Image Demons** whose function is very simple. They note the *arrival* of a pattern from the environment and pass it in a suitable form to the next group of demons for further processing.
- *Stage 2* This is accomplished by

Feature Demons Each Feature Demon is responsible for searching the input pattern to detect the presence or absence of a certain characteristic *feature*.

For example, if the input patterns are essentially visual in nature, one Feature Demon might look for the occurrence in the image of a horizontal straight line, another for a vertical straight line, yet another for a continuous curved line, and so on.

•*Stage 3* This is the domain of the **Cognitive Demons**. A Cognitive Demon is entrusted with the task of assuming responsibility for one *pattern class* out of all those which are to be identified.

Each Cognitive Demon scans the activity of the layer of Feature Demons and looks for the occurrence of features which belong to his particular pattern class. For example, if the pattern classes correspond to the letters of the alphabet, then one Cognitive Demon will be looking for the features which make up the letter 'A', another searching for the features of a 'B', and so on.

At this stage the derivation of the name of this model becomes apparent, for each Cognitive Demon signals the presence of his particular features by shouting. The more of his assigned features he sees, the louder he shouts.

•*Stage 4* The final stage is carried out by a single Demon, the **Decision Demon**. His job is to listen to the pandemonium produced at the previous stage and determine *which* Cognitive Demon is shouting the loudest.

The Decision Demon then identifies the original input image as belonging to the class associated with the loudest Cognitive Demon.

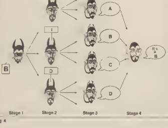


Fig 4

The emphasis in this model is on the processes required to carry out the pattern recognition task, rather than on any particular implementation of a system. Let us now see how this basic scheme could be used to design a computer based system for pattern recognition.

A computer-based pattern recognition system

Let us take as an example a system to recognise one of the eight letters of the alphabet A, B, C, D, E, F, G, H. (The principle can easily be extended to as many classes as required, but eight classes will allow us to base our example on a typical microcomputer with storage in the form of 8-bit bytes.)

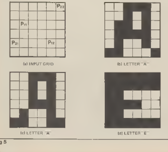
If our system is going to be computer-based, then it is most convenient to represent our characters in a digitised format as an array of black and white points on a specified input grid. Figure 5 shows some typical examples of letters which might occur in our character set represented in this way.

An added bonus of representing our patterns as discrete points is that an internal computer representation is easily generated by labelling, for example, a black point with a binary 1 value and white point with a binary 0 value.

In this system, let us select our features in a very arbitrary fashion, as follows.

A *feature* will be defined as the binary pattern occurring on a randomly selected pair of elements on the input grid. For example, let us select the pair of points labelled P_{11} and P_{12} in the grid of Figure 5 (a). Now, when an actual pattern is projected on to this grid the P_{11} P_{12} pair might assume any one out of four possible assignments of binary values. The pattern of Figure 5 (b) will set the P_{11} P_{12} pair to 11, that of Figure 5 (c) to 01, and so on.

Inside the computer we reserve a byte (8 bits) of storage for every binary com-



(a) INPUT GRID (b) LETTER "A" (c) LETTER "A" (d) LETTER "E"

Fig 5

bination which may occur each bit position corresponding to one of the eight possible pattern classes to be identified If we now assume that all the points on the input grid are grouped randomly into pairs P_{11} P_{12}, P_{21} P_{22} P_{31} P_{32} each pair having a corresponding set of four bytes of storage in memory, then we can divide up the computer memory in the way illustrated schematically in Figure 6

The operation of this system depends critically on its initial exposure to a selection of patterns as *examples* of typical patterns which might occur in each of the possible pattern classes

Consider the two versions of the letter 'A" in Figure 5 (b) and 5 (c) For each of these two patterns we identify the binary state of each pair of points P_{11} P_{12}, P_{21} P_{22}, and write a binary 1 value into the corresponding storage location under the appropriate bit number (in this case, bit number 1, which corresponds to the pattern class 'A") The procedure is repeated for all the chosen pairs of grid points and for a number of examples of each class, allowing the computer memory to build up a complete picture of the characteristics of all the pattern classes corresponding to the letters A B H The patterns shown in Figure 5 would in fact, produce the bit pattern in memory shown in Figure 6

In use, the system then operates in a very simple way When presented with a letter to be identified, each pair of points P_{11} P_{12}, P_{21} P_{22}, will address just one

location (bit) in memory The computer scans all of these addressed memory locations and totals up the number of stored ones in column 1 (Class A) column 2 (Class B) column 3 (Class C) column 8 (Class H) By selecting the maximum score among the eight totals the computer is then able to assign the input pattern to the class which gave the maximum score (the class which had the most features in common between the test pattern and the typical examples from which the machine learned)

It is clear that this computer implementation of a pattern recognition system is based very much on the general purpose PANDEMONIUM scheme introduced earlier and although very simple in principle can be very effective (The details of such a system will become very much clearer if you select some example patterns from the various possible categories and work through the steps described above to complete an entire memory map)

For better performance we might wish in practice to select the features as groups of more than two points on the input grid, the actual choice depending on the characteristics of the data to be processed It is this arbitrary selection of groups of n points as pattern features which gives this *n-tuple* recognition technique its name

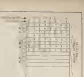


Fig 6

It should be stressed in conclusion that the techniques which have been illustrated here deal with only a few of the possible approaches to pattern recognition and are in fact those which are the simplest to understand and illustrate Other approaches are possible and may often be more effective Although a substantial part of this article has for the purposes of description and illustration been devoted to the recognition of two-dimensional visual patterns in the form of alphanumeric characters it should be apparent that the techniques are general purpose provided that suitable features can be found and selected

In the next article we shall deal explicity with the topic of computer vision and see how the recognition of visual patterns is only one problem which must be solved if a machine is to be made to sense its visual environment in a realistic and meaningful way ■

We guess 70,000 people read issue one
We believe more read issue two
We now know Computer Age is a winner

1 'I have seen the first two issues of your magazine and consider it to be very useful for the non-specialists whom we are attempting to reach'

Neil Crichton Miller Director
Management Studies Centre ICFC

2 'I would like to congratulate you on your first issue Both the selection of topics and the level at which the articles are aimed, make the magazine a worth-while buy for anyone interested in the microprocessor revolution'

Michael Bray Computer Consultant

3 'From reading the first issue of Computer Age it would appear that your publication is an applications-oriented one But the articles are much better than those found in U S applications-oriented computer publications'

Eric Somers McMartin Industries Nebraska USA.

4 'Congratulations on getting it going Your first number has set the standard which we had come to expect and I am sure that you will attract usual and a growing following'

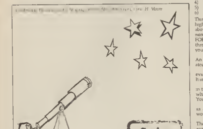
Edward Hawthorne Author of The
Management of Technology

When people keep telling you you're good, you have to believe it.
Join Computer Age by taking out a subscription. See foot of page 80

LEARNING FORTH

A miscellany

[illegible] H Moore



Reverse Polish Notation

It has been suggested that some readers may not be familiar with Reverse Polish Notation (RPN) as used by FORTH and incidentally by BURP (Basic Using Reverse Polish) which is a language used by the Wireless World Scientific computer* and the whole range of Hewlett Packard calculators. To read a line of arithmetical calculation in RPN you run your eye along until you come to the first operator (such as +, * cos) and then use it in a logical fashion on the numbers which precede it. Some operators are *unary* operators that is to say they need only a *single* operand (number). Cos is such an operator. Some are *binary* in that they need *two* operands. Plus (+) is such and times (*) is such another

```
2 Cos
```

means evaluate the cosine of 2 whilst

```
2 Cos 1 +
```

means evaluate the cosine of 2 and add 1

It helps the clarity if a double space separates cos and 1

```
2 cos  1 +
```

The power of RPN lies in the fact that no rules concerning brackets are necessary neither is an 'equals' sign. Whilst it is an advantage to write down a complicated expression in order favourable to RPN it is never necessary. Any expression can be tackled in the order in which it is written. You enter the first number (operand) and if there is an operation you can carry out on it you do so. Otherwise you leave it there and pass on to the next number. It will wait patiently until numbers above it have been processed and each such process feeds it up. Consider an extreme case

$$X = 6(3 + 2(4 + \cos 2))$$

Evaluated directly in RPN this is

```
6 3 2 4 2 Cos + * + *
```

Five dangling operands before the first operator!

You write down each number in succession and then list the operators reading backwards along the line. In FORTH nothing happens till you hit RETURN at the end. That is the way I would do it in FORTH if I were just using FORTH as a calculator.

I couldn't do it like that, however, on my H P 29C calculator since the stack isn't big enough. The initial 6 would drop out. It would be necessary to change the order to

$$((\cos 2 + 4)2 + 3)6$$

Evaluated in RPN this is

```
2 Cos 4 + 2 *3 + 6 *
```

and no operands are left dangling

You [illegible] that there are no rules about brackets [illegible], from the inside out although [illegible] what happens in both [illegible] RPN takes care of it. What are the rules then? They are as follows

1) Place number on stack
2) If there is a unary operator next, do it
3) Place next number on stack
4) Repeat 2
5) If there is a binary operator next do it
6) Place next number on stack

This goes on to ternary operators and higher. (Try writing a flow chart for the above procedure.) A simple example of a non-arithmetic ternary operator is the FORTH word ROT which rotates the top three numbers on the stack. To remind you

```
1 2 3 ROT 2 3 1
```

An example of an arithmetic ternary operator is the FORTH word */

```
A B C */
```

evaluates A * B/C

It is different in its effect, from

```
A B * C /
```

in that the product AB can be up to 31 bits whilst the simple A B * is a 16 bit number. You could even regard the operator

```
Cos + * + * ,
```

as a quinary operator and so define the word

```
WHIZ COS + * + * ,
```

Then in the unlikely event of having to evaluate a large number of expressions of the form X you could write

```
A B C D E WHIZ.
```

Where A B C D E is any set of parameters.

Getting up to a few antics such as this really gives you the *feel* of FORTH. For fear you might be misled I must point out that cos is not a Forth word and if you want to use such trigonometric functions you must define the appropriate words.

A further illustration. To evaluate a polynomial

$$6x^5 + 5x^4 + 4x^3 + 3x^2 + 2x + 1$$

This is best written

$$((((6x + 5)x + 4)x + 3)x + 2)x + 1$$

If we had x 5 times in succession on the top of the stack

```
x x x x x
```

We could proceed by

```
6*5 + *4 + *2 + *2 + *1 +
```

Each successive * uses up an 'x

You could define the word POLY thus

```
POLY 1 DO DUP LOOP
6*5 + *4 + *3 + 2 + *1 +
```

To use it you write

```
6 5 POLY
```

Where 6 is a chosen value of x and 5 is the highest power of x. The LOOP gives 5 successive values 6 and the rest evaluates the polynomial. For an amusing example which none the less points the way to the use of FORTH in precision arithmetic we define the word AB thus

```
AB/ CR CR SWAP OVER /MOD %  "
ROT 0 DO OVER 10 SWAP */MOD % LOOP
DROP DROP ,
```

The words which require explaining are

CR	(Carriage return)
MOD	(Divide 2nd on stack by the top leaving remainder)

---

* Powertran designed by J H Adams

%   (Prints without any space)
Use, N A B AB/
Result, it prints out the result of dividing A by B to N decimal places where N is unlimited!

```
( EXAMPLE 1978/1977 TO 200 PLACES) OK
OK
200 1978 1973 AB/

[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
22OK
```

Some other features of Appleforth 5

The HEX dump feature is interesting because it gives both the usual HEX listing of a program or definition together with the ASC11 values by the side. As an example we list out the definition AB/ just quoted. It was written into what is called SCREEN 4 which is part of a memory area set aside for definitions and editing. (There are 6 such screens each of size 1K)

```
HEX OK
1100 130 DUMP
 1400   20 20 20 20 20 20 20 20
 1408   20 20 20 20 20 20 20 20   .
 1410   20 20 20 20 20 20 20 20
 1418   20 20 20 20 20 20 20 20
 1420   20 20 20 20 20 20 20 20
 1428   28 20 55 53 45 20 20 20   ( USE
 1430   4E 20 41 20 42 20 41 42   N A B AB
 1438   2F 20 20 20 57 48 45 52   /   WHER
 1440   45 20 4E 20 49 53 20 54   E N IS T
 1448   48 45 20 20 20 20 20 20   HE
 1450   20 44 45 53 49 52 45 44    DESIRED
 1458   20 4E 55 4D 42 45 52 20    NUMBER
 1460   4F 46 20 50 4C 41 43 45   OF PLACE
 1468   53 20 29 20 20 20 20 20   S )
 1470   20 20 20 20 20 20 20 20
 1478   3A 20 41 42 2F 20 43 52   : AB/ CR
 1480   20 43 52 20 32 44 55 50    CR 2DUP
 1488   20 2F 4D 4F 44 20 25 20    /MOD %
 1490   2E 22 20 2E 22 20 52 4F   ." ." RO
 1498   54 20 44 52 4F 50 20 20   T DROP
 14A0   52 4F 54 20 30 20 44 4F   ROT 0 DO
 14A8   20 31 30 20 2A 20 53 57    10 * SW
 14B0   41 50 20 32 44 55 50 20   AP 2DUP
 14B8   2F 4D 4F 44 20 25 20 52   /MOD % R
 14C0   4F 54 20 20 2E 20 20 20   OT  .
 14C8   20 44 52 4F 50 20 4C 4F    DROP LO
 14D0   4F 50 20 44 52 4F 50 20   OP DROP
 14D8   44 52 4F 50 20 43 52 20   DROP CR
 14E0   43 52 20 3B 20 20 20 20   CR ;
 14E8   20 20 20 20 20 20 20 20
 14F0   3B 53 20 20 20 20 20 20   ;S
```

The ASCII characters enclosed in brackets are comments to remind the user of the way to use the definition. Anything enclosed between brackets is ignored by the compiler. You notice the word HEX at the beginning. This puts the system into HEX from DECIMAL and it will remain in HEX until you decide to change it. In the original version of FORTH the screens are sectors on a disc, but in the version I am using, and in the PROGRAMMA version for PET and APPLE etc. they are memory locations. When you are in one of these you have the ability to edit your text. In the 1.5 version this is done by means of control commands

- Control N moves the cursor up
- Control B moves the cursor down
- Control L moves the line the cursor is on, and all text below it down, leaving a blank line in which to insert text
- Control Q deletes the cursor line and closes the gap
- Control I enables text to be inserted at the point in the line at which the cursor is placed (Control A gets out of this mode)
- Control D deletes the character on which the cursor sits and closes the gap
- Left and right arrows allow cursor movement

When you have finally edited the text to your satisfaction you then type

- S followed by Control E which escapes from the editor mode and
- Load compiles the defined words into dictionary

Comments may be inserted anywhare even within a definition by means of the FORTH word (" This being a word, requires a space to be left before the first character of the comment e.g.

(THIS IS A COMMENT)

The PROGRAMMA INTERNATIONAL version uses a different method. When in a screen you use **Line numbering** (automatic if you want). The last line of the screen is then used as an edit line. Anything written in it may be inserted as a line into the existing text or used to replace a line of the text. Both of these are simple and powerful editing systems.

A Forth Programme

To finish off this rather discursive article we ought to have another program. I choose a digital filter software implementation.

A digital filter is a device into which an input stream of data is fed at fixed time intervals. The output at any instant is dependent on the state of the device and the value of the input. The state of the device however is dependent upon previous inputs and outputs. In some way we are all such devices! Our reaction to a stimulus depends upon our experience both of the effect upon us of the stimulus and of the results of our previous reactions. However a digital filter should be relied on not to change its state in the interpulse interval. A simple type of filter is one in which the output depends on the input and the immediately previous output in the following way

$$X_n \rightarrow \boxed{\qquad} \rightarrow Y_n$$

$$Y_n = K_1 X_n + K_2 Y_{(n-1)}$$

This is called a first-order-lag filter.

If K_1 & K_2 are less than one and

$$K_1 + K_2 = 1$$

we have a low-pass filter. Such a filter can show for example the trend in the values of X whilst smoothing out short-term fluctuations. You might be tempted in this case to write

$$Y_n = K_1 (X_n - Y_{n-1}) + Y_{(n-1)}$$

but the truncation errors would be greater in integer arithmetic.

We define variables A1 A2 B1 B2 in the usual way -

```
O VARIABLE A1 ETC
```

and a variable to denote a time interval. This latter is not necessary in the present case but is useful for scaling a graph (I shall discuss graphics in a later article).

```
O Variable T
```

Then

```
      INIT 0 T ! B2 ! B1 ! A2 ! A1 ! ,
            K1 A1 a A2 a */ ,
            K2 B1 a B2 a */ ;
```

(To start we type N N N N INIT)
Which establishes the values K1 & K2
Eg -

```
2 13 11 13 INIT
```

Then -

```
      : LAG K1 SWAP K2 DUP   ,
```

USE

```
            Y0 X1 LAG
```

SUBSEQUENTLY

```
         X2 LAG X3 LAG Etc
```

X1 X2 X3 could be the readings of your electricity meter or any other set of data which requires smoothing. The smaller the value of K1 the greater the smoothing effect. Noisy signals can be cleaned up by storing the signals on tape or directly in memory and feeding them through the LAG programme at leisure. The precision of the arithmetic is generally adequate here but you might like to improve it along the lines of the AB/ example. ■

'What's this I hear about you having a good time in real time?'

BRINKMANSHIP

I once had a chat with that ubiquitous person, 'Someone in the City', about the financial aspects of the personal computer business. What I was particularly interested in was gaining some measure of the problems of financial management for companies entering the business from a money-man's point of view.

For example, asked I, what are the problems involved when a company is operating in a market with very rapid growth rates? "Define what you mean by very rapid growth rates," said Someone in the City. "Oh," says I, "around the 15 to 20% mark on average."

"Fifteen to 20% per year is not that rapid," he replied knowledgeably.

"Maybe so," I said, "but I was talking growth rates per month, not per year."

"Hold on", said he, frantically working his calculator in the background and muttering strange city-type expletives like 'cash-flow crisis'. "Let us say," he responded eventually, "that should this fictitious company lose control of its financial management for something longer than a minute and a half it could be in very serious trouble.

"And don't think I'm exaggerating or joking, because I'm not. On paper it doesn't actually seem to work out."

We had been talking partly because it was his job as an investment analyst to study new opportunities in and around the general electronics industry for clients wishing to sink their funds and hopefully make them grow. We ended our conversation with him impressed with the opportunities that were available for making money for his clients through exploiting the potential of the personal computer market, especially in the small business sector, but at the same time perplexed about the potential problems involved in managing any company so invested in.

Now, those theoretical discussions, that took place during the middle of last year, have come to something of a reality. At the end of 1979 the Byte Shop chain, which outside of London trades under the Computerland banner, hit financial problems and a receiver manager was called in to salvage it and keep it trading by the company's two major backers, the Charterhouse Group and United Electronic Holdings.

This month's saga is not about the Byte Shop story in particular, more about the story as a general guide to the way events might just be turning, both for the people on the inside of the business, making a living from making, distributing and selling the systems, and those on the outside having bought or planning to buy a system.

There are two very pertinent facts relating to the personal computer business — especially for those on the inside. Fact one is that it is an industry with one of the most explosive growth rates ever seen, and as yet there is no sign of those growth rates slowing down to more tolerable levels.

Fact two is that managing a company operating in such an environment is probably the world's worst job. The bosses of the many new companies that have sprung up over the last year to eighteen months are perpetually chasing a financial shadow, and are unlikely to be anywhere near catching it for some time to come.

Though the details of what happened to the Byte Shop chain are not particularly relevant to the overall problem — and in any case by the time this is read will have probably been resolved one way or the other — a brief outline of the events that led up to the receiver-manager being appointed has some validity.

The chain was started in mid-1978 by Bill Cannings, who opened one shop in Ilford, North London. By the early part of last year he had attracted the interest of the Charterhouse Group and United Electronic Holdings, which jointly took an equity stake in the company and made financial loans for further investment. This money was used to follow an aggressive attack on the market, with a total of five additional shops being opened around the country during 1979.

It would appear that it was this route to the marketplace that led to the company's problems, by overstretching the financial resources available.

It does *not* mean, however, that the route was intrinsically wrong.

Certainly it was one that would require a degree of financial management beyond the scope of most people not specialising in financial matters. It would be safe to assume, however, that such management skills would not be beyond the scope or talents of a company like Charterhouse — which operates in the merchant banking and investment financing field.

So, with strong financial controls, and no expectations of an immediate return on the investment, the route followed by the Byte Shop chain could have put it into the position of dominating the marketplace for non-specialised marketing of small computer systems throughout the country. In two years time, if not earlier, it would have been in an ideal position to recoup the original investments, plus a great deal more.

Before reaching that point, however, the company was obviously going to be teetering on the edge of financial collapse almost permanently, and the rug could be pulled from under it at any time.

As I have already said, the details in themselves are not particularly relevant to this saga, for it is liable to be a continuing one for the whole business, and there are lessons to be learned from it. They are lessons for the manufacturers and sellers of systems, for those who have or are thinking of investing in such companies, and, indirectly, for the potential customers.

Taking the last group first, the financial problems of the type to which the Byte Shop chain has temporarily succumbed will affect other companies, will probably get worse, and will lead to a probably not inconsiderable shake-out of the companies currently in the business. By the law of averages if nothing else, many of these companies will go to the wall.

The lesson for the potential customers is, unfortunately, that even those operations with apparently sound financial backing can prove to be vulnerable. For the customer such vulnerability can only exacerbate any worries they may have about buying systems, for they will need to know that support is still going to be available in the future.

For those in the business, the lesson is that it matters very little how much you know about hardware, software, systems or applications if you do not know enough about financial *management*. In a business where the growth rates, and consequently the cash requirements, are high enough to perplex experts from the City, then financial management skills must be the all-important pre-requisite to survival.

But even getting the support of a money-man who has such skills offers no guarantees to the people in the business, and this is the lesson to be learned for the potential investors.

It is becoming apparent that many who might consider investing in the business, primarily because the potential for high returns on those investments are very good in the long term, need to gain *a much wider understanding of what the business is about*.

This does not mean learning about the technology. What it does mean, however, is that they must come to understand that all investment must be *long term*. Where growth rates are 15-20% per month, not per annum, the companies would need to be operating on totally unrealistic margins to generate any cash return to the investor. Where the growth rate equals the operating margins of a business then the profit has to go straight back into it. This can be taken two ways by an investor: either that the company is on course to recoup the investment at a later date when growth has slowed and the overall market is much bigger — so that the margin starts being real, tangible, money, or it can be taken as a prelude to insolvency. ■

Editor's Note: As ... [illegible] ... Byte Shop both the ... [illegible]

Buy here at discount prices!

Save money-

☆ Full after sales service in our own workshops ☆ One year guarantee on all machines

Up to 1·6Mb for PET!

and on hire with the Computhink Disc System

*Allows powerful business programmes using 18 Extra BASIC commands *Easy to connect and use - plugs directly into 16/32K PETs - detailed manual supplied *Simple startup (no 4-stroke procedures to remember) as Disc Op System in ROM *Ready to run - useful programmes supplied free - full set of professionally written business packages available - Sales and Purchase Ledger Stock Control Payroll etc *Real Time processing Eng naming and Commercial boundaries overcome with full language support - Business BASIC Assembler FORTRAN COBOL PASCAL FORTH FIFTH PLM PILOT & CESIL

Basic 400K dual disc system only

£840

800k £1 395
1.6 Mb £2 199

24K Memory expansion with dual disc for old ROM 8K PET £375
for new ROM 8K PET £320

Credit terms available

The only 16k complete computer for under £400

keyboard computer power supply UHF modulator and all cables to plug into your own TV set and cassette recorder and go!!
16K of user RAM for decent size programmes and data sophisticated level II microsoft basic
Fully converted to UK standard including frame sync frequency (no wobbly display)
Tandy don't do that!
Complete with level I and level II programming manuals What more could you ask?

£399

Extra numerical keypad £33.00

Expansion interface complete with 32K RAM £280

This lot must be today's best buy!

Get into print this easy way!

Fast!

Anadex DP 8000 dot-matrix printer

*Speedy 112 ch/s bi-directional *Fits A4 page - up to 80 cols *Up to 4 copies *Precision form filling with sprocket feed *Special headings using double-width chars *Modern paper format to match A4 filing systems *Other paper sizes with adj. sprocket *Full punctuation U/L case 96-char set *Reliable - strongly built 100 M char head

Knock down price!

£499

Interfaces
Pet £45 Ohio £10
TRS-80 £12 Sorcerer £6
Apple £80

Immaculate!

IBM golfball printer ideal for word processing

*Forget expensive Spin-Wheel printers - the Golfball produces equal quality at up to 15 ch per sec *Match various typeface styles with IBM interchangeable heads *Completely refurbished - each machine rebuilt by IBM trained engineers and fully guaranteed *Precision form filling possible with 15 in pin-feed platen

Limited supply!

£595

Interfaces
Pet £45 Ohio £10
TRS-80 £12 Sorcerer £6
Apple £80

Silent!

Trendcom 100 thermal printer

*Stop disturbing others with noisy printout! *Neat clean 96-char set U/L case & symbols *Matches Pet/Apple line lengths *Fast 40 ch/s print *Reliable - robust only two driven parts *Plug in and go - built in PSU data led manual *Thermal paper 4½ in wide is 40% less expensive than electrosensitive paper

While stocks last

A snip!

£249

Interfaces
Pet £45 Ohio £10
TRS-80 £12 Sorcerer £6
Apple £45

PET 2001-8N

(8K RAM New large keyboard)

£469

2001 – 16N (16K RAM and new large keyboard)	£590
2001 – 32N (32K RAM and new large keyboard)	£890
External cassette deck suitable for all Pets	£53
CBM dual drive mini floppy	£745
CBM tractor feed printer with Pet graphics	£605

You can afford to start computing now! – with the Ohio CI-P

As imported fully tested complete with 4K RAM but unconverted to UK std (conversion instructions supplied)

£199

Add £24 for converted model
Extra 4K RAM £38

Powerful programming console - 6502 processor - fast 8K Microsoft floating-point BASIC (easy to learn) Superior abilities 53 key keyboard giving upper and lower case user-definable keys gaming and graphics etc. Ultra fast and powerful machine code from keyboard *No circuit soldering or metal work. Computer supplied assembled in ready made case *Reasonably sized programmes in 4K RAM *Expandable to 24K RAM at cost - floppy discs printer etc available Items include Assembler/Editor and Extended Monitor *Programme interchangeability reliability Kansas City tape interface *Save programmes on own cassette recorder - all cables supplied

at a lower price than equivalent kits!

Leasing available to companies

COMPUTERAMA LTD.

Please add £10 Securicor delivery on computers etc plus 15% VAT on all prices

Tel: Bath (0225) 28819

Your dealer for Bath, Bristol and S W

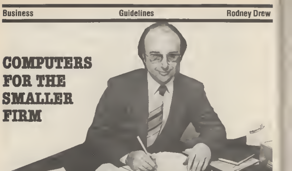
CA/3

Computerama Ltd.
Harpers Kensington Showrooms
London Rd. Bath Avon

Credit card orders accepted by telephone for immediate despatch

Rodney Drew

COMPUTERS FOR THE SMALLER FIRM



The author is a managing consultant with ICFC Consultants the largest firm of management consultants advising medium sized and private companies in the UK ICFC Consultants is part of the Finance for Industry group a wholly private enterprise institution ICFC (Industrial and Commercial Finance Corporation) was set up in 1945 and is the prime UK source of medium and long term funds for small and medium sized companies

Here we can do little more than skim the surface of a subject as complex as computer data processing It has been written primarily for the Chairman/Managing Director of the small or medium sized company, contemplating computers for the first time

An attempt has been made to answer the questions, "What sort of equipment are we talking about?" and "What is the order of cost?" This has been done based on first hand experience of prices and equipment available during 1979

In a business we buy and sell pay staff produce accounts and list details about our stock and about money we owe or are owed All these processes involve paper — purchase orders invoices payslips ledgers and balance sheets — on which we record the necessary details We record the *data*

The generation recording, updating and extraction of data are the individual aspects of a company's *data processing*

We may therefore say that data processing, or d.p is synonymous with trading

Towards the end of the nineteen-fifties the first electronic machines were introduced to assist in processing data and gave rise to the term electronic data processing or *e d p* The person in charge of such equipment and its staff was often called the E D P Manager Over the years his title has been abbreviated to D P Manager We have now become accustomed quite wrongly to assuming that data processing implies the use of an electronic computer whereas data has in fact been processed clerically for a very long time

The new Adds system 70 for the small business user

- **Data and information**

We record data in order that we or others may be informed Since it is only through data that we can become informed we may feel that data and information are the same thing — What information do we have on Mr Smith's account? — What data have we? It is, however, important to make a distinction

Data can be thought of as facts or characteristics suitably presented for communication Information on the other hand, is a person's interpretation of the data

Different persons may arrive at quite different conclusions from studying the same data Consider how economists vary in their opinions

But if data is not information, it is certainly the basis for information The more complete the data and the more aptly it is presented the greater the likelihood that interpretations will not differ

• Data as a cost

In any business somebody has to keep the books This need may require support from invoice typists credit controllers order clerks and others whose job it is to process data Such staff although essential, are only indirectly involved in the productive or money creating aspects of a business — we refer to them as indirect staff

All these people need somewhere to work, they need filing cabinets and desks typewriters and calculators and materials such as paper and carbons They also require to be paid to be insured and have provision made for their pensions

In short processing data is an expensive business

• Data as a resource

But data should not be viewed just as a necessary evil — it can also be a most valuable asset

It is from analysing recorded data that we are able to establish trends evaluate company performance and make decisions on policy

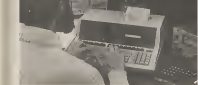
The more accurately more completely, more timely and more appropriately the data is recorded, the better we shall be informed and therefore more able to realise the company's full potential

This asset or resource of data can be applied to the process of creating money, as well as to that of preventing financial loss

Many businesses neglect this resource so that decisions are often based on inadequate information This omission can affect a company's very survival

How can a computer help?

When asked What is the use of a computer?" many people reply that it makes it possible to do things more quickly They sometimes add the word accurately And basically it is the need for speed with accuracy that lies at the heart of most decisions to use a computer



New HP 85 computer from Hewlett Packard designed for personal use in business and industry by professionals

Guidelines

Let us list just some of the many instances in data processing where computer power can be applied

• Speeding throughput

With the aid of a computer the normal time for the completion of work can be brought forward For example customers' monthly accounts can be made available within hours of the month end instead of several days later with the possibility of improving cash flow

• Coping with volume

With company growth the volume of work to be handled either becomes unmanageable by the existing number of staff An increase in staffing may not be the best answer because of difficulty in obtaining the right kind of people or because the extra work does not justify the additional overhead cost or simply because the nature of the requirement cannot be met by using more people In these circumstances the computer can be used to cut down the amount of processing handled by clerical staff

With the help of a small office computer one person can achieve the throughput of several invoice typists

• Smoothing peaks

Most companies are troubled at some time or other by the uneven flow of work During slack periods staff may be underemployed whilst at times of pressure delays may occur in the completion of work Both situations can lead to staff discontent

A computer removes these problems of peaks by absorbing smoothly the impact of differing work loads

• Easing access to information

There are many situations where immediate access to recorded data of all kinds is desirable yet not possible through conventional methods of filing and updating

For example when orders are being received over the telephone we would like to be able to say immediately whether stock is available When queries occur relating to a customer's account we would like to have the account to hand with details of all transactions posted pending or being queried

continued on page 64

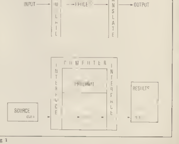


Fig 1

LP ENTERPRISES

Room C A
8 11 Cambridge House
Cambridge Road, Barking,
Essex IG11 8NT England

Telephone 01-591 6511

BOOKS/MAGAZINES/SUBSCRIPTIONS

BY OSBORNE

Introduction to Microcomputers Series

Vol 0 Beginners Book	£ 6.95
Vol 1 BASIC Concepts	£ 6.30
Vol 2 Some Real Microprocessors (without binder)	£ 18.95
Vol 2 Some Real Microprocessors (with binder)	£ 24.70
Vol 2 Updating supplement set Nos 1 6	£ 17.00
Vol 3 Some Real Support Devices (without binder)	£ 11.95
Vol 3 Some Real Support Devices (with binder)	£ 17.70
Vol 3 Updating supplement set Nos 1 6	£ 17.00
1 binder (Specify for Vol 2 or 3)	£ 5.75
1 Updating supplement (Specify for Vol 2 or 3)	£ 4.00
See Subscriptions!	
6800 Programming for Logic Design	£ 6.30
8080 Programming for Logic Design	£ 6.30
Z80 Programming for Logic Design	£ 6.30
Z80 Assembly Language Programming	£ 6.45
6502 Assembly Language Programming	£ 6.45
8080A/8085 Assembly Language Programming	£ 6.45
6800 Assembly Language Programming	£ 6.45
Accounts Payable and Accounts Receivable	£ 10.95
Payroll with Cost Accounting	£ 10.95
General Ledger	£ 10.95
Some Common BASIC Programs	£ 6.30

GENERAL

See Magazines and Subscriptions! *See Osborne Books!*

Microprocessors from Chips to Systems	£ 7.00
Microprocessor Interfacing Techniques	£ 8.75
TV Typewriter Cookbook	£ 7.50
Cheap Video Cookbook	£ 4.30
CMOS Cookbook	£ 7.50
IC OP AMP Cookbook	£ 6.95
RTL Cookbook	£ 4.25
TTL Cookbook	£ 7.50
Ciarcia Circuit Cellar	£ 5.50
First Book of Kim	£ 7.00
Buyers Guide to Microsoftware	£ 2.40
Calculating with BASIC	£ 4.95
Computer Programs that Work (In BASIC)	£ 2.55
BASIC Software Library (Listings)	
Vol 1 Business and Games Programs	£ 17.50
Vol 2 Maths Engineering and Statistical Programs	£ 17.50
Vol 3 Advanced Business Programs	£ 28.95
Vol 4 General Purpose Programs	£ 7.95
Vol 5 Experimenters Programs	£ 7.95
Vol 6 Miniature Business System	£ 32.50
Vol 7 Chess/Medbil/Wdproc Programs	£ 26.95
Vol 8	
Bar Code Loader for 6800 8080 Z80 and 6502	£ 1.75
Best of BYTE	£ 8.95
Scelbi BYTE Primer	£ 8.95
Best of Creative Computing Vol 1	£ 8.95
Best of Creative Computing Vol 2	£ 8.95
Program Design	£ 4.25
Programming Techniques Simulation	£ 4.25
PIMS — A Database Management System	£ 5.95

FOR THE Z80

See Osborne books!

Z80 Instruction Handbook (Wadsworth)	£ 2.95
Z80 Microcomputer Handbook (Barden)	£ 7.50
Z80 Software Gourmet Guide and Cookbook	£ 7.95

FOR THE 6800

See Magazines and Subscriptions! *See Osborne Books!*

6800 Software Gourmet Guide & Cookbook	£ 6.95
6800 Tracer An aid to 6800 Program Debugging	£ 3.95
Tiny Assembler	£ 5.75
RA 6800 ML — An M6800 Relocatable Macro Assembler	£ 15.95
Link 68 — An M6800 Linking Loader	£ 5.50
MONDEB An Advanced M6800 Monitor Debugger	£ 3.50

CONCERNING LANGUAGE

SCELBAL High Level Language Supplements	£ 15.00
Instant BASIC	£ 6.95
Basic BASIC	£ 5.50
Advanced BASIC	£ 6.00
My Computer likes me when I speak in BASIC	£ 2.75
Users Guide to North Star BASIC	£ 10.00
A Practical Introduction to PASCAL	£ 3.95
Microsoft BASIC	

FOR THE 6502

See Magazines and Subscriptions! *See Osborne Books!*

Best of Micro Vol 1	£ 6.50
Best of Micro Vol 2	£ 5.50
Programming the 6502 (Zaks)	£ 7.95
Programming the 6502 (Foster)	£ 6.75
6502 Applications	£ 7.95

FOR THE 8080

See Osborne Books!

8080 Programmers Pocket Guide	£ 1.95
8080 Hex Code Card	£ 1.95
8080 Octal Code Card	£ 1.95
8080 Software Gourmet Guide & Cookbook	£ 6.95
8080/8085 Software Design	£ 6.75
8080 Standard Monitor	£ 9.95
8080 Standard Assembler	£ 9.95
8080 Standard Editor	£ 9.95
8080 Special Package Monitor Editor Assembler	£ 20.00
BASEX A Simple Language and Compiler for the 8080	£ 6.50

FOR FUN

SARGON a Chess Game	£ 9.50
BASIC Computer Games	£ 5.00
More BASIC Computer Games	£ 5.50
What to do After you Hit Return	£ 8.95
8080 Galaxy Game	£ 5.95
SUPER WUMPUS — A game in 6800 Assembler Code & BASIC	£ 4.25
Computer Music Book	£ 6.75
Computer Rage (A board game)	£ 8.95
Artist and Computer	£ 3.95
Games Tricks and Puzzles for a Hand Calculator	£ 2.40
Introduction to TRS-80 Graphics	£ 5.75
Take My Computer Please (Fiction)	£ 3.25
Introduction to Low Resolution Graphics	£ 5.50

FOR THE NOVICE

See Magazines and Subscriptions! *See Osborne Books!*

Your Home Computer	£ 5.95
Introduction to Personal and Business Computing	£ 4.95
Getting Involved with Your Own Computer	£ 4.75
How to Profit from Your Personal Computer	£ 5.50
Microcomputer Potpourri	£ 2.40
Hobby Computers are Here	£ 3.95
New Hobby Computers	£ 3.95
Understanding Microcomputers and Small Computer Systems	£ 6.75
Understanding Microcomputers and Small Computer Systems and Audio Cassette	£ 8.75

MAGAZINE BACK ISSUES

Micro 6502 Journal	£ 1.50
Personal Computing	£ 1.95
Interface Age	£ 2.95
ROM	£ 1.95
Dr Dobbs Journal	£ 1.95
Computer Music Journal	£ 3.75
Peoples Computers (now called Recreational Computing)	£ 1.95
BYTE	£ 2.95
Creative Computing	£ 1.95
Calculators and Computers	£ 1.95
Kilobaud	p.o.a
Compute — for the 6502	£ 1.95
68 Micro	£ 1.95
Magazine Storage Box (Holds 12)	£ 1.25

MAGAZINE SUBSCRIPTIONS (all processed within 3 weeks)

Micro 6502 Journal (12 issues)	£ 12.50
68 Micro (12 issues)	£ 17.50
Personal Computing (12 issues)	£ 17.00
Interface Age (12 issues)	£ 26.00
Dr Dobbs Journal (10 issues)	£ 13.50
Computer Music Journal (4 issues)	£ 11.00
Recreational Computing (6 issues)	£ 8.50
BYTE (12 issues)	£ 24.50
Creative Computing (12 issues)	£ 16.50
Kilobaud Microcomputing (12 issues)	£ 21.00
Compute for the 6502 (6 issues)	£ 10.50
Introduction to Microcomputers Vol 2 Updates (Issues 7 13)	£ 18.95
Introduction to Microcomputers Vol 3 Updates (Issues 7 13)	£ 18.95

LP ENTERPRISES

Room C A
8 11 Cambridge House
Cambridge Road Barking,
Essex IG11 8NT, England
Telephone 01 591 6511

FOR BONUS DISCOUNTS see below software details

	Software & Manual / Manual only
Computers Plus Inc	
FMS-80 (File Management System)	
Demo Pack (includes manual & demo disc)	£ 35 00
Complete System	£395 00/25
Computer Services	
Bi directional driver for diablo Hytype printers for use on CP/M & CDOS systems	£ 85 00/15
CP/M User Library	
33 Volumes	£ 4 00 ea
Creative Computing Cassettes	
PET-8K	
CS 1001 Logic Games 1	£ 6 50
CS 1002 Number Games 1	£ 6 50
CS 1003 Logic Games 2	£ 6 50
CS 1004 Graphic Games 1	£ 6 50
CS-1005 Graphic Games 2	£ 6 50
CS 1006 Conversational Games 1	£ 6 50
CS 1201 Simulations 1	£ 6 50
APPLE II — 16K	
CS 4001 Space Games 1	£ 6 50
CS-4002 Sports Games 1	£ 6 50
CS-4003 Strategy Games 1	£ 6 50
CS-4201 CAI Programs 1	£ 6 50
EXIDY SORCERER — 8K	
CS 5001 Graphic Games 2	£ 6 60
OSI CHALLENGER & SUPERBOARD II — 8K	
CS 6001 Graphic Games 3	£ 6 50
TRS-80	
CS 2001 Games 1 (4K level 1)	£ 6 50
CS 3001 Board Games 1	£ 6 50
CS 3002 Space Games 3 (16K level 2)	£ 6 50
CS 3003 Adventure (16K level 2)	£ 12 50
CS 3201 Ecology Simulations (16K level 2)	£ 19 50
Creative Computing Discs	
For CP/M	
CS 9001 BASIC Computer Games disk 1	£ 12 00
CS 9002 BASIC Computer Games disk 2	£ 12 00
CS 9000 Both discs purchased together	£ 20 00
Creative Solutions	
Multi FORTH	£ 65 00/20
Digital Research Operating Systems	
CP/M for North Star	£105 00/15
CP/M for MDS 800	£ 65 00/15
CP/M for Cromemco	£ 65 00/15
CP/M 2 0	£100 00/21
SID	£ 45 00/12
MAC	£ 55 00/15
TEX	£ 45 00/12
DESPOOL	£ 30 00/ 5
Information Unlimited Inc	
WHATSIT (Database Management System)	
on North Star	£ 59 00
on CP/M	£ 75 00
on APPLE 2 48K	£ 72 00
on APPLE 2 32K	£ 59 00
on ITT (see Apple)	

	Software & Manual / Manual only
L P ENTERPRISES	
Diablo Driver runs 110 to 9600 baud with autoload for CP/M or CDOS (vers 2 17)	£ 50 00/ 5
Micah Inc	
CP/M for CDOS Users	
Program to Expand CP/M system to be compatible with Cromemco CDOS software	£ 59 00/ 5
Disc Utilities	
Pack one for CDOS users includes Fast discopy Track test Diskstart and others	£ 50 00/10
Pack two for CP/M users includes same as in pack one	£ 50 00/10
Pack three for Cromemco users includes as pack one and Spool & Print	£ 95 00/10
Michael Shrayer	
Electric Pencil Word processor	
SSII for TTY etc	£125 00/15
DSII for Diablo	£150 00/15
TRS 80 Cassette	£ 50 00/10
Microfocus Ltd	
CIS COBOL version 4 2	£425 00/25
FORMS 2	£100 00/10
Micropro Inc	
WORD MASTER	£ 85 00/20
TEX WRITER	£ 45 00/15
WORD STAR	£200 00/25
SUPER SORT version 1	£130 00/20
version 2	£110 00/20
version 3	£ 85 00/20
Northshare	
Multi user system for North Star Users	£ 24 00/ 5
Osborne Associates	
Some Common BASIC programs for PET or cassette	£ 10 00
Cassette and book	£ 15 00
Software Systems	
CBASIC Compiler	£ 75 00/15
Software Works	
North Star Format only	
Inventory 1 (Stock Control)	£ 50 00/10
Inventory 2 (as 1 with order entry)	£125 00/15
Mailroom	£ 50 00/15
Housekeeper (various utility programs)	£ 35 00/10
Preventative Maintenance	£ 75 00/15
Structured Systems	
Accounts Receivable (Sales Ledger)	£350 00/15
Accounts Payable (Purchase Ledger)	£350 00/15
General Ledger (Nominal)	£485 00/15
NAD (Converted to use UK postcodes)	£ 50 00/10
Qsort	£ 50 00/10
Letterright	£115 00/10
Analyst (file management system)	£115 00/10
Tiny C Associates	
Tiny C language for 8080 Z80, 8085 systems	
Manual contains all source code	£ 35 00/35

BONUS DISCOUNTS

a) For the purchase of 3 or more books and paying by cheque P O or cash with the order give yourself a 10% DISCOUNT

b) For the purchase of 3 or more magazine back issues and paying by cheque P O or cash with the order give yourself a 10% DISCOUNT

c) For the purchase of 2 or more software packages and paying by cheque P O or cash with the order give yourself a 10% DISCOUNT

For more information on any of these items please phone write or visit (We are open during office hours)

All publications are published in the U S A and are stocked in Britain by L P Enterprises Prepaid orders are despatched by return of post or advice concerning

HOW TO ORDER

Send cash postal order cheque or credit card number to L P Enterprises Room C A 8/11 Cambridge House Cambridge Road Barking Essex IG11 8NT All payment must be in Sterling and drawn against a U K bank

Please note If you wish to pay by Diners Club credit card we must have your signature For any payment by credit card we need the expiry date of the card and the address that the credit card company knows although we can send the goods to an alternative address)

For the purchase of software please add VAT and £1 50 for First Class postage packing and insurance

Due to fluctuations of the dollar prices are subject to change without notice

TRADE ENQUIRIES WELCOME

from page 62

In functions such as credit control buying and stock recording, the collation of data is often both complex and time consuming Problems may arise due to the removal of records by others needing information, or it may be found necessary to produce multiple copies of records with the problem of keeping them up to date The manual control of centralised records can be an expensive operation It may also led to staff frustration and disharmony

Computer technology now offers even

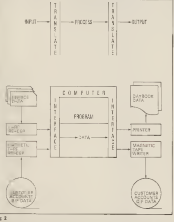


Fig 2

to quite small enterprises a way of maintaining centralised records which are up to date and immediately accessible without any of the drawbacks mentioned above

- **Increasing management knowledge**

How often does management need answers to questions such as

— How do sales compare with the forecast, by unit and by value?
— How do they compare when analysed by product group and by individual product?
— Have we such figures for each month and totalled year to date to compare with last year's performance?
— Can we split this sales data to compare the performance of sales areas both home and export?

Guidelines

Again in conditions of rapidly rising costs

— Which products are returning a margin of profit that has become inadequate?
— Is there a need to revise our product mix?
— Are there parts of the business which are no longer profitable?

The answers to all these questions are probably obtainable from existing data within the company but only but a huge clerical effort which is not only costly but may produce results too late to be of help

Computers however can analyse recorded data in a variety of ways both quickly and accurately, to provide management with vital information that is also up to date

- **Highlighting irregularities**

In a well ordered business most activities run smoothly and management need to be told only about irregularities Speed is vital especially if accounts become overdue or if low or high stock levels develop By means of a computer such problems are quickly highlighted

In 'Reporting by Exception', a computer can automatically inform management about problems as they actually develop, enabling early action to be taken for their correction.

What is a computer?

The British Standards Institute defines a computer as 'any device which is capable of automatically accepting data applying a sequence of processes to the data and supplying the results of these processes

By defining the computer in terms of what it can do rather than its technical features we include any device which performs automatically a sequence of processing steps on data We call the sequence of automatic steps a *program* (Much of the new jargon that has arrived with computers is relatively simple — see Glossary for definitions of some of the more common terms)

We may break down any application on a computer into a series of stages as shown in Fig 1 Data originates in a source is processed by a program in the computer and is recorded at some destination in its revised form

The source data is called *input* and the resulting processed data is called *output* For a limited period the data will be inside the computer — the processing device

There are therefore three states of data — INPUT INTERNAL and OUTPUT these equate with the three stages of processing BEFORE, DURING and AFTER

The form of the data in each of these states will vary, depending on the recording medium chosen For example, an order document will need to use numbers and words The same data on becoming input to the computer will normally require presentation in another form, such as holes in punched paper tape or punched cards On receiving the input, the computer will almost certainly convert the data again before processing, and yet again when producing the required output — which may be a management report or in a form for use as input at a later processing stage

The point of transition from one data form to another is called an *interface*

Figure 2 shows a typical computerised process Sales invoices have been recorded on punched cards and we now wish to post these amounts to our customer accounts, held on magnetic tape We will produce an updated version of the customer accounts on a second magnetic tape and at the same time print a daybook legend of the postings

It will be noticed that coupled to the computer interfaces are a number of supplementary devices, namely a card reader printer, magnetic tape reader and writer These are known as *peripherals*

Peripherals provide the means of passing data into and out of the computer data *store* or *memory*

Some peripherals enable data from the computer store to be recorded on a medium, such as magnetic tape from which the data may be read back into the computer store at another time The recording medium is known as *backing store* and in effect increases the computer's storage capacity

Two other ocmputer terms in common use are *parameter* and *field*. These are the what and where' when defining computer data If we consider a typical questionnaire, which has a box for an answer against each question, then the question identifies the parameter being sought and the box is the field where the value of the parameter is to be placed

In general terms a parameter is some *specified mesurement* for a unit of data, e.g height in centimetres, weight in kilograms or age in years while a field is the *location* for recording such a measurement

Figure 3 depicts a typical computer installation

The user is primarily interested in what needs to go into the computer system and having what subsequently comes out of it in an understandable form The actual technology used is not of interest providing it offers a reliable and cost effective solution to his data processing needs

Types of computer

- **Pre-computer machinery**

(For daybook analysis, computer input preparation, ledger postings, etc)

Before the price of computers came within the reach of the small business, a degree of automation was already being achieved through the use of invoicing and accounting machines

These machines, although not strictly computers themselves, provided an early bridge to computerised data processing

The bridge was made by connecting paper tape punches to the machines In this way it was possible to capture data from the on-going activity of generating invoices, producing deybooks or posting ledgers The data was then passed to a computer service bureau

This *by-product* data could be used in a variety of applications such as the preparation of sales analyses, customer statements production schedules, stock evaluation and management reports

The use of invoicing and accounting machines has become less popular today, as the costs of such equipment have risen while at the same time relatively inexpensive small business computers have become available

- **Visible Record Computers (VRC)**

(Used in financial accounting stock recording, payroll by-product data preparation for major analyses by larger computers, etc)

As machinery in the accounting area became increasingly powerful, greater attention was given to the design of ledger and stock cards so that handling might be increasingly automated

These cards were moved nearer to the machine so that the operator would have ready access for *pulling* the various records for processing — on the lines of the old card tabulator systems

With a visible record computer, the operator posts transactions by entering the appropriate recording card into the machine and operating the keyboard. One transaction may affect a number of different records For example, an invoice might update the customer ledger account, the VAT account, the sales analyses record and the stock records This updating is achieved while the actual invoice set is being printed

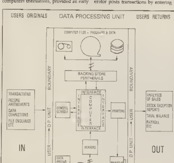
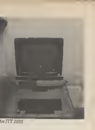


Fig. 3



An ITT 2020

During the processing a great amount of the work is being done automatically by the computer Record cards are aligned and positioned for receiving the updating entry and are also checked to establish that they are the correct cards In many cases base data, such as customer address and terms of business is read directly from the card generally through coded holes at the edge of the card — *edge punched cards* or by means of a magnetic stripe *Magnetic striped ledger cards* can also record changes that may be read automatically in a subsequent run

The computer will have a number of selectable programs which may be revised by the user or be of a type that can only be changed by an engineer or by the manufacturer, such as the program read only memory or PROM type

The great attraction of this class of computer is that the current state of all processed records is visible to the user hence the term 'visible record computer'

Advances in technology, and the wider availability of relatively inexpensive *visual display units* (vdu's) — similar in appearance to a television set — have provided an alternative means of access to recorded data in a visible form The conventional visible record computer with its centralised card filing, is probably entering a period of decline or change, with the introduction of more powerful systems offering improved data access at little extra cost

- **Mini-computers**

(General purpose computers for all types of application industrial, commercial, scientific, process control — where data volumes are usually those associated with the small to medium sized concern)

When the term mini-computer was introduced in the 1960's it described a computer having most of the facilities of a larger conventional machine but constructed as a much smaller unit with the help of new technology

As time passes the distinction between the traditional computer and the mini computer is becoming less distinct.

A mini-computer may be characterised by

- a not requiring air-conditioning
- b not requiring specially designed accommodation
- c having low power consumption and able to be plugged into the standard supply through a 13 amp socket
- d being compact — possibly the size of two filing cabinets
- e costing less than £25 000 for a minimum installation

Mini-computers operate more slowly than contemporary larger machines although are often faster than the bigger earlier generation computers

The mini-computer now makes it possible for more firms to have their own in-house computer system With the increased availability of standard programs modified to take account of individual needs it is possible for a company to have its own computer department without the expense of employing skilled staff such as analysts and programmers Furthermore as a company grows it is often possible to increase the computer's power to handle the greater workload

Visual display units can be used with most mini computers and will provide quick, visible access to recorded data

Some machines will support a number of visual display units with access to recorded data being made available to several people at the same time

■ Micro-computers

(For specific applications of data collection, data analysis or in support of larger computers systems by performing a particular sub-function)

The term micro-computer originally described a further technological advance in

Guidelines

miniaturisation

The technical aspects of this advance need not concern us except to understand that small *dedicated* systems are now being used in areas formerly excluded by cost or through the environmental or technical operating requirements

Examples of micro computerisation are programmable pocket calculators and weapon and rocket borne guidance systems Micro-computers are also being used to solve problems of incompatibility among computers generally

As micro computer technology develops some extremely powerful and robust devices with large and rapidly accessible memories are becoming available which are very small in size They herald the ultimate replacement of a computer room full of equipment by a micro computer no bigger than a suitcase

For the present many simple business systems are now becoming available on micro-computers from £5,000 upwards including software

A booklet devoted to micro-computers will be available later in the year from ICFC Consultants

■ Main-frame computers

(General purpose computers for every sphere of application)

The main frame computer is the traditional computer which has evolved from the valve machine first available commercially in the second half of the 1950 s

They became known as *main-frame* to distinguish them from the emergent mini-computers and other data processing machinery which although separate from the larger computer were satellites to the main-frame

The first main-frame computers were bulky and expensive difficult to program and somewhat temperamental They required extensive preventative maintenance and could involve a switching-on procedure lasting an hour or two, before they were passed for use by the engineer

These valve or *first generation* machines gave way to the more rugged semi-conductor or *second generation* machines during the early 1960 s By the middle of the decade the *third generation* computers were with us These provided for the more efficient use of the computer's *central processor* and introduced a new dimension for future expansion

Machines most popularly referred to as main-frame are likely to involve the following

- a an air-conditioned environment,
- b a planned accommodation with air and cable ducting, and perhaps false flooring,
- c a special power supply with automatic voltage control,
- d skilled operators, with systems generally designed as well as written by in-house analysts and programmers
- e a cost for a very basic unit in excess of £100 000

■ Other Computers

We have now covered the types of computers most commonly encountered There are however a number of other classes which mainly owe their titles to the role they play in the data processing activity For example

- a Terminals the name given to a host of devices which collect transmit or receive data at some point remote from the main processing computer Most of these devices would have a keyboard and some form of display such as a printer or screen A number will also be capable of some processing of the data they handle — these are called *intelligent* terminals,
- b Point of Sale (POS) a specific kind of terminal designed to capture data at the point of sale The more sophisticated examples will read *bar coded* commodity tags through the use of a hand held *light pen* and transmit details to a central computer, stock records are kept up to date and bills of sale produced automatically as well as analysis of sales
- c Word Processors machines which process typed data and provide powerful editing facilities sometimes coupled with arithmetic calculation and extension functions They offer increased efficiency of throughput in larger typing pools in organisations where legal documents are prepared and in other situations where a substantial proportion of different documents comprise tracts of identical or similar prose

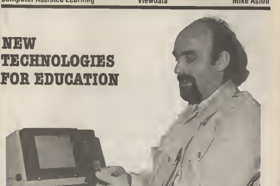
● *To be continued*

Lion Micro Computer's team in their Tottenham Court Road micro computer centre The company has now begun a hire service Among microcomputers available will be the LSI11 Horizon and Attache

Next Issue *Assessing the need for a computer Bureau services Partial systems In house systems Supporting services New development Consultancy assistance Glossary of terms*

Editor's Note *The use of photographs in this and other articles is for illustrative purposes and does not imply endorsement of the products featured*

NEW TECHNOLOGIES FOR EDUCATION



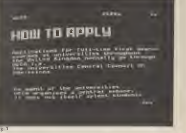
Mike Aston using a business viewdata terminal

This fourth article from a member of the Advisory Unit for Computer Based Education Hatfield is by Mike Aston its Deputy Director

New technologies have always provided educationalists with tremendous opportunities but the nettle has rarely been grasped successfully. We can cite both programmed learning machines and language laboratories as examples of this phenomena. The impact of television in the classroom is difficult to assess, but its effect in the home has been highly significant in changing social patterns and family life.

Viewdata, by fusing the power of the computer the telephone and television provides us with the greatest opportunity to stimulate learning since the introduction of the printed word. Are we ready and able to accept the challenge? Stringent economies in the education sector have created major problems for any institution wishing to become involved in developing the use of Prestel (the Post Office version of viewdata) as an educational tool and thus assisting in shaping the nature of the provision. Nevertheless, much work is being done and in this article we shall look at some of the problems encountered and the opportunities offered by the new media.

Prestel (or viewdata as it was first known) became available to a limited number of educationalists during the pilot trials which began in 1976. Early information providers included the Open University the Universities Central Council on Admissions (UCCA) and St Albans College of Further Education Hertfordshire. Initially the system was seen simply as a means of disseminating information about education. UCCA ranked highly in this field with its comprehensive approach to finding a suitable university course. The Caxton Publishing Company has put up an entire encyclopaedia with associated general knowledge quizzes using two different methods of retrieval one for the novice



HOW TO APPLY

Fig. 1

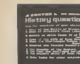


Fig 2

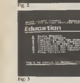


Fig 3

and one for the expert using the old alphabetic telephone dialling code One or two colleges have provided further education course finders and several local authorities (in London, Hertfordshire Birmingham and Norwich) have collaborated with the Association of Special Libraries and Bureaux (ASLIB) in providing educational community information (see figure 3 for range of coverage) If we browse through the frames available we might come across information on grants legal aspects curricula and regulations educational aids advisory services reading lists bibliographies careers advice job opportunities, educational research and teaching aids All this, of course is available from other media but the four important innovations are that it is available on demand in the home, from one source and it is up-to date

The next stage of evolution was the realisation that the medium was not just an information machine Staff at the P O Research Establishment at Martlesham Heath had the opportunity to experiment with a more sophisticated viewdata system than that available to the public An interactive capability which enables students to make responses those responses to be assessed and the results of the assessments to be instantaneously provided to reinforce understanding or assist in self-correction offers a tremendous scope for the development of Computer Aided Instruction (CAI) and Computer Aided Learning (CAL) the essential difference being that the emphasis is on the *system* with CAI and on the *individual* with CAL The choices on the CAI/CAL index frame give an indication of what will be possible on a viewdata system in the not too distant future

- 0 An experiment in Programmed Learning
- 1 Junior School Topics
- 2 Multiple choice questions
- 3 CAI Under Task Control
- 4 Examination/Revision Notes
- 5 Graded Quizzes
- 6 Previous Examination Papers
- 7 Computer Aided Instruction
- 8 The Laboratory on the Screen
- 9 Decision Making in Medicine

Choice 3 provides a possible glimpe of things to come The student is presented with an instruction text on elementary thermodynamics dealing with the steam engine and turbine The subject matter is broken down into a number of sub topics and their relationships to the main topic is an essential element in the understanding of the whole This method of learning is based on the 'entailment structure' concept created by Professor Pask Choice 9 presents the medical student with an emergency simulation The conditon of the patient can be improved or deteoorate according to decisions made at the key board If the patient' dies he can be resurrected and the student has an opportunity to have another go Clearly, this is better than learning on real people!

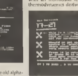


Fig 4

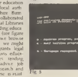


Fig 5

The public Prestel system currently does not offer such luxuries of interaction By skilful use of the frames and a special facility known as a response frame some information providers have managed to present the user with quite good learning packages The Printing Industry Research Association (PIRA) has experimented with programmed learning on topics such as offset lithography and on-line bibliographic searching St Albans College offers a mathematics test with scoring at the end of a series of multi choice questions

In the not too distant future we may be able to locate an evening class enrol and pay by keying in a credit card number all from a comfortable armchair in the home. The idea of one-line voting or even referenda is also a real possibility Already a debate on 'law and order' backed by crime statistics is available on Prestel with the opportunity to vote on the issue at the end of the presentation via a response frame

Telesoftware

The advent of microcomputers already spreading to many homes and schools gives rise to the question — how do we distribute software to such a variety of locations? The answer is telesoftware This is the generic term for the transmission of computer software either via a viewdata system or broadcast via a teletext system Three experiments are currently being carried out Computer Analysts and Programmers (CAP) have developed a language called micro COBOL and put up some programs on Prestel which can be downloaded into intelligent terminals and run locally The Independent Broadcasting Authority are transmitting software via their ORACLE teletext service and lastly the Council for Educational Technology (CET) has set up a research project to distribute CAL packages written in BASIC to microcomputer users in schools

CET are currently setting up an educational umbrella information provider service for any institution interested in becoming involved in Prestel without incurring the substantial P O service charge Prestel is beginning to become available to domestic users and early this year the Post Office will be giving this new medium a massive publicity campaign to increase public awareness Whether we like it or not there will be a shift of emphasis from work to leisure in the eighties and I suggest that even more learning will take place in the home than at present The roles of the school the

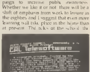


Fig 6

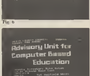


Fig 7 *Mike Aston selections, visiting card*

teacher and the parent will all change quite drastically and the new currency of information will [illegible] what [illegible] have been [illegible] considered.

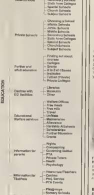
● [illegible]

APPENDIX ONE
GLOSSARY OF TERMS

VIDEOTEX	International generic term to cover both viewdata and teletext
TELETEXT	Generic term for textual information displayed on a TV screen which is broadcast by a TV company
CEEFAX	Teletext system transmitted by the BBC (non interactive)
ORACLE	Teletext system transmitted by the IBA (non interactive)
VIEWDATA	Generic term for textual information displayed on a TV screen which is obtained via a telephone line (interactive)
PRESTEL	The British Post Office's version of Viewdata
IP	Information provider
UMBRELLA IP	An IP who takes a block of pages and re-lets in smaller quantities
USER	A person who is authorised to retrieve information from the Viewdata system
KEYPAD	A small keyboard by which a user accesses the data base (may be numeric or full keyboard)
VIEWDATA RECEIVER	A television which has been specially adapted to receive and display the frames of information
TREE	A hierarchical data structure which is represented pictorially as an inverted tree. The data is considered as leaves of the tree which are accessed via branches
FRAME	The physical unit of data. The user will see one frame at a time on the screen. The size of the frame is 960 character positions — 24 rows of 40 columns
PAGE	The logical unit of data. It is made up of one or more (up to 26) frames
PAGE NUMBER	The number of a page defines the position of the page in the tree
EDITING SYSTEM	A system which enables an IP to update his part of the database
CUG	Closed User Group. A facility for Information Providers who wish to keep a section of the viewdata base unavailable to the general public
RESPONSE FRAME	A frame which provides a facility which enables the user to respond to the IP perhaps for further information or to signify a purchase using a credit card number

INTELLIGENT TERMINAL	A terminal which [illegible] limited number [illegible] fully independent stand alone [illegible] complete [illegible] which is compatible with viewdata [illegible]
TELESOFTWARE	Generic term for transmission of computer software via viewdata or teletext. Requires a suitable microprocessor and memory in user's terminal
AVIP	Association of Viewdata Information Providers (the IP trade association)
INSAC	A UK company set up by the National Enterprise Board responsible for overseas marketing of viewdata

APPENDIX TWO
The Community Education Tree on Prestel



Missed out on something good?

Issue 1

[illegible] Are games playing programs intelligent? Artificial intelligence and the layman. Micro computers in education. Algorithmic designs. How mighty micros can aid super sales. Why not a computer in your business? Some microcomputer uses in psychology. Learning FORTH. Office of the future and much more

Issue 2

The government's views on computers. Cultural energy and the personal computer. Tribute to Christopher Evans. Micro computers in the legal professions. Accountants' guide to micro computers. The behavioral connection. Topics in artificial intelligence. Why not a computer in your school? Brand news and much more

Issue 3

Faceless bureaucrats — an invasion of privacy? Buying a personal computer. Statistical analysis on a micro. Doing it in binary. The small systems market hots up. Book reviews. When we're all ten years older. Database. The modular approach. Optimising employment

Each back issue costs 50p (including postage and packing). Write to Computer Age, 4 Valentine Place, London, S E.1.

SYSTEMS FOR SMALL BUSINESSES

In her third series of interviews with first time users, Marlene Brown *talks to* Vonralme and The Kitchen Shop *where the small computer is very big business*

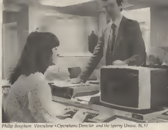
Expanding and prospering as never before, *Vonralme* an investment holding company is offering a "user oriented" system to many of its own associate companies in the form of a complete, on-line computer bureau service Vonralme's overriding aim is to provide a flexible and efficient service to meet its customers' varying needs Taking total responsibility for the success or failure of their computerised system Vonralme's Operations Director, Philip Bingham, says "Our company has a split personality We just want to perform a service for our 'small user' customers because it looks like something that will be a worthwhile income earner and we are pursuing it on that basis "

The change at Vonralme began in February last year when, on the recommendation of a satisfied customer, Bingham approached *Sperry-Univac* and leased from them the BC/7 microcomputer at a cost of £28,000 spread over a five-year period The BC/7 model is a disc system having 128K main memory, a 200 character per second printer two workstations, 20 Mbyte hard disc a keyboard and VDU Further expansion allows the introduction of up to six workstations and four printers System software is Sperry's own suite of commercial application packages called UNIVISA (Univac's Integrated System of Accounting) vetted and approved by an international firm of accountants and auditors, in the industry standard language RPG II or Univac's own high level programming language called ESCORT

Lease payments every month cover rental £656 maintenance £213 Univisa £84 and Escort £20

"We wanted everything from one supplier," says Philip Bingham "someone who knew the machine and the software for that particular machine We had to give Sperry certain standard parameters for the package, and that package can now be very quickly adapted to any new user that comes along He went on to explain "We have a standard set of discs we use for new customers, provided they do not want anything too exotic and are prepared to adapt slightly their own systems to the system that is required by the package Then we can put them on ourselves without calling Sperry in all the time to help us

When the system was implemented two years ago none of the staff at Vonralme had any previous data processing experience — they all came from the world of banking and finance, but it took only a few weeks for them to create productive work from the computer "When we purchased the computer, one of our girls went over to Sperry's offices in Holborn and used a similar machine to start putting up the files for our first application the mailing list says Bingham "When she came back, she trained the other staff here who now know how to run it If the girls go at night, I can



Philip Bingham Vonralme's Operations Director and the Sperry Univac BC/7 close it down and start it up again in the morning because I know what is happening all the time

The bureau service was first developed to fully support one of their major customers World Wide Knitting Publications with a large subscriber mailing list of 7000 names and addresses 'The move is in response to the needs of our first customer and now many of our other customers want to do accounting through us

With the growing demand for their services, Vonralime soon found they were doing far more work for their customers who came first in preference to their own needs We wanted to run a bureau system using our NCR32 because we were not utilising it all day long, but we found our customers' applications were such the the NCR would be inadequate so we had to look around for something bigger, explains Bingham All Vonralime customers have to be small, and not too specialist so that the applications package can be slightly tailored to fit into the participative operating style of each user company In the future Vonralime intends to intensify its efforts to develop applications software to suit its customers varying needs

The flexibility of the operating system has been developed to provide an accurate and efficient accounting function with purchase and sales ledger programs invoicing, general ledger and stock control

Vonralime's operating company London Capital Securities came to them for a specific accounting applications package and their associate company Broadwick a sub-contractor in the building industry, asked for help in devising a suitable payroll system for all their labourers each paid weekly on a different day In the week Building labourers move from site to site employer to employer as and when the work changes At any one time an employer can have 100 labourers with a turnover of about 25 per cent a week A man can work for one week go away the next come back work for a few more weeks and then go away again The payroll package specially written by Sperry Univac now allows Broadwick to develop a fast and efficient method of paying all building labourers on the correct day in the week

At first we had a lot of bugs in the payroll application because when the week number changed automatically for the next week, we found everybody was getting an extra week's tax allowance says Bingham Some sites are paid on a Monday and others on a Tuesday Wednesday Thursday or Friday so we are apparently the only employers who do not pay everybody on the same day in the week he adds

Another Vonralime associate company, a courier service called Same Day Delivery relies heavily on the bureau system to handle increasingly large volumes of paperwork from the flow of invoicing and payments of commission to salesmen The system has allowed the company to drop their manual system move apace with a larger customer requirement and handle increased productivity with relatively the same number of inhouse staff

Two Users

Philip Bingham says that the boss of the company or his senior management should play a continuing role to take key decisions both before and after the system is installed "The boss should be aware of all the possibilities of the programs and should also be willing to do some of the writing of his own programs, because he has got to be satisfied that the computer is producing all the information he requires he adds Sperry Univac run a series of two-day management appreciation courses and *Rune Nyman* Vice-President of Univac Small Business Systems says Our training programmes for non-technical staff and also for management helps them to understand the computer environment how the business system works and what it can do for them

Sperry Univac has recently announced the sale of its 500th BC/7 in 20 months since April 1978 when it set up the Business Systems Marketing Organisation and launched the BC/7 in France Germany and the UK Of this total almost 190 systems have been sold in the UK Sperry Univac state that development with compatibility and upwards expansion throughout the BC/7 family range of machines is extremely important to all their users or prospective users

'Our company has a split personality'

Says Nyman 'The real major breakthrough over the last few years is that the small businessman can now plan with the same efficiency and he can check his stock inventory in the same way as the big guy because the small computer now gives him a similar capability Nyman says that the small business environment is the same as for the larger corporations with virtually the same requirements except that the mass of data is much less

The profile of the typical BC/7 user has remained consistent over the past two years and Sperry Univac claim that its penetration and success would probably be within the distribution segment of the market amongst companies employing between 20 200 staff and/or a turnover of £500 000 to £14 million The market split has been approximately 70 per cent into distributive companies 15 per cent into manufacturing, the balance into professional or service companies

This success has largely been due to the availability of UNIVISA which has been proved to be one of the more comprehensive commercial packages available on a small business system' says Rune Nyman ESCORT has proved consistently popular, allowing non-EDP trained users to write their own programs the user is able to talk with the computer, and it is this continuing interaction which seems to be the main attraction to the first-time user market 'Escort tutors you as you go along," explains Philip Bingham 'You speak English to it by keyboard and it gives you a series of options on what you want to do it tells you if you are making any mistakes and it even edits your program for you

He adds It *escorts* you through the program and we find it very useful especially in writing the mailing list for our first customer With Escort Vonralime are producing a variety of management reports using the files as a database and the language is used on any application that is not part of the UNIVISA package

Again waxing eloquent on the simplicity of ESCORT, Bingham describes the system 'ESCORT has a tutorial mode where it assumes you know absolutely nothing, it takes you through everything step by step, and once you become familiar with that you can go on to a command mode where you just tell it what to do you can insert a line above it or below it, change it or print out the whole program All you have to do is say 'Hello! This is what I want to do and it will come up with a series of options or menus to choose from Once you get more acquainted with it you can write your own programs and you don't have to be a qualified programmer

Janet Finch Taylor, Univac's Press Officer says With ESCORT our customers can gain experience of the computer and should their requirements change as a result of that experience they have no need to resort to expensive and often unobtainable programmers to write the additional programs

The UNIVISA range of packages for the BC/7 caters for a large variety of user requirements in the areas of financial accounting order processing, sales invoicing, stock management general ledger and payroll A more specialised standard package has been developed for the manufacturing industry and other specialist areas — the clothing industry construction and contracting motor dealers and freight forwarding

RPG II is the main programming language Bingham says it is easy to implement on the BC/7 Everything is written in RPG II on UNIVISA and you don't have to write anything on the keyboard apart from the input of data you don't have to give any commands because everything is easily displayed on the menu and you just go on keying in the input underneath the various headings and transmitting it into the processor he says

According to Philip Bingham Sperry Univac are dedicated to meet the true needs of the small business user and they have never once failed him on support "Fortunately Sperry are in Holborn which is within walking distance from our offices here so we can telephone their customer support rep and get an immediate answer to any problems

"We get a lot of backup from our Univac salesman and he was not just selling the machine," says Bingham "He was well acquainted with the systems and the programs, he became interested in following

Two Users

it up and helping us with any problems we had with our customers. One rep is allotted to us, and if he is out with a customer at another location when we need him, then there are other Univac customer support reps who can help us. If it is a problem on the operating system, then we can get an immediate answer, but if it is a problem where the adaptation has been slightly modified by our own rep or by ourselves then obviously they cannot give an immediate answer and we might have to wait until the next day.

"Initially, when we first installed the system we had to go to Sperry for assistance quite a lot because we were making mistakes in following the procedures. The procedures one has to follow are very strict, but the Univac manuals are very well written."

The company have not had a hardware problem that has lasted too long, but if the computer is down for any length of time, they could go to Sperry's offices in Holborn and buy time. "The trick is to provide a large customer engineering group to do the maintenance and if there is any problem the customer can call up and within a few hours there will be someone there," says Rune Nyman. Offering a total support solution to meet the genuine needs of the small company, Nyman says that Univac will always provide a good service specially for the small businessman where it is more difficult for him to have his computer down for a couple of days. "We have emphasised to our customer engineering and support people that the small business user is very important to us. All our users, regardless of size have a maintenance agreement with us and that agreement is basically the same so we are looking after the small guy as well as we look after the big guy."

Vonralime's customers want a computer system that is thoroughly reliable so they can go to the bureau and talk to Philip Bingham and his dp staff without having to do their own software themselves or employ their own computer personnel. "As a computer bureau, we are small enough to be of interest to someone who feels he does not want all the responsibility himself, he just wants to go to a bureau and ask them to solve his problems," says Bingham.

For the future, Vonralime foresee a demand for their bureau service and plan to expand the equipment to higher performance computing systems. "We want to get more workstations in the future because we want our users eventually to have their own workstations with a printer and vdu. When they become more acquainted with the machine themselves, they will then take more responsibility for their own work. If we do everything for them they tend to expect more and they tend not to be acquainted with the problems," says Bingham.

Bingham admits there is a communications gap between the user and the computer industry. He says users have to be restrained at times because their own manual system is often inadequate in not performing what they want it to do, and when they do have a computer-based system they expect the computer to provide far more then they really need. "They ask for little things they had no requirement for before but they often put it out just to try to see how good your system really is and I think they just want to make a point that your computer cannot do everything," he says.

Bingham's advice to the first-time user is "Make sure that the supplier you are buying the computer from can provide all the services, the hardware, software, engineering backup and support, and look very carefully at the human problems that are likely to arise afterwards."

With the recent announcement of the BC/7-900, a four partition system with a 50% increase in processing speed, increased memory capacity and greater application flexibility, Univac claim that the BC/7 can now protect the slightly more advanced system user, particularly as more enhancements are shortly to be announced. The smaller user is not forgotten and Sperry Univac is currently promoting the availability of its 1MB diskette drives on systems costing as little as £13 000. Also, recently launched is Mini Univisa, the commercial accounting package for the smaller BC/7 configurations.

Sperry Univac will continue to sell on customer support and service because as Rune Nyman says, "We realise that the small businessman must have and should have the same attention as the larger corporation based on the contract we have signed with him. We will continue to give the support which has been enjoyed by our existing installations."

APPLE 11 Application The Kitchen Shop

The Kitchen Shop

Getting an accurate line on kitchen design is an intricate task but not if you use an APPLE or an ITT 2020 microcomputer. *Douglas Wallis*, managing director and chairman of *Starr Wallis*, and his wife Starr, use the screen and keyboard in place of the traditional drawing board method to design and plan their kitchens. "It is a highly complex task designing kitchens but if you are meticulous in detail and clever in the way you do it you can generate a very high gross profit. If you are slipshod you can lose a lot of money because getting one centimeter mismeasured can cost you £300 at a stroke," says Wallis.

Wallis and his wife say the computer gives them speed with accuracy, it is easy to use and has great customer appeal. Seven years ago, they set up a retail business called *The Kitchen Shop* selling luxury items in Stratford upon Avon, Warwickshire. Coolly professional, with technical ability and an eye for detail, Wallis went into kitchen design and now runs a profitable and flourishing business with two factories and six full-time staff, with a turnover of £200 000 per annum.

He says he was fortunate to have met *Myles Pollock* of *Templeman Software* who headed the programming team who designed the system and wrote the applications programs. At the start it was agreed that Pollock would supply the hardware and develop the software, but would retain the rights to the system. The deal was a decisive step to designing a software package, the first of its kind.

The computer is a 48K APPLE with high resolution graphics, one disc drive and a Dolphin character printer, and it cost £3 725. This simple system uses a domestic television and a small disc unit, and the microcomputer weighs less then 11 lbs. It can be expanded to include a printer that will print the agreement for the customer, the parts required for the supplier, and draw out the kitchen plan for the installer.

"In the past we had a big drawing board, we took a plan of the room and drew in all the units If it didn t work we would rub it out and draw them in again ' says Wallis On a complex design it could take him more than 10 hours and now it is reduced to a maximum of one hour on the microcomputer where the entire system is cleaner faster and more accurate on pricing

To me it is a saving because I would have had to have another designer in to cope with the work at that stage and it would have cost me something like £10 000 plus per annum ' he says Customers love it because if a customer comes in and looks at the screen he or she immediately understands We find it is a common thing — with an ordinary drawing, you have a husband and wife, you explain to them what is happening and you find that the wife does not quite understand the scales of the drawing off ice plan We never have that problem with the screen We have people coming in who don t even know what a centimeter looks like, but once they return home they can telephone you and say You know that 50cm wide unit 150cms from the kitchen door, do you think we could have it changed? If the housewife changes here mind any unit can be removed, replaced or moved elsewhere and the new layout redrawn in about 20 seconds The system allows the designer to choose the scale he requires for each kitchen "

Another significant advantage Wallis says is that because the visual impact of the screen is so different to the drawing board the customer can have the whole picture or he can built up the kitchen unit by unit, wipe it out or change it as he goes along Wallis and his client work together in front of the screen keying in the dimensions until a plan appears showing the kitchen sink, doors, windows and other units After seeing it twice my customers understand it says Wallis with a smile ' Customers have tremendous faith in the computer because it never allows the designer to make any inaccurate positioning At the drawing board if you are one centimeter out in the dimensions of the room when you come to fit something and it is that much too big then you have had it!

Wallis encourages his customers to make changes on the spot Once they have got over the initial fear of asking for a change to be made they are quite happy to experiment and try it out themselves

The system consists of five programs

- plan and design a kitchen
- price and design a kitchen for any range of any manufacturer
- draw elevation and calculate tile requirements
- draw the plan of the kitchen onto a graph plotter or Qume printer
- design the worktops

The computer draws an outline on the board showing the dimensions and features of the room To draw out an average square or L shaped room will probably take two minutes and to design the kitchen plan less than 15 minutes I dial in the measurements and as I get the room the way I want it, I start playing around with it putting in a number it unit explains Wallis He has taken every conceivable unit in the European code system and given it a universal code number If you come across a unit you have never seen before you can apply the code and the computer automatically tells you what that code is and will draw the outline plan If you do not want it you delete it A deleted unit is stored until it is required in another version of the plan

Two Users

It takes Doug Wallis an hour to present a design on screen and he estimates that to plan and build ten kitchens would take about ten hours He admits it is worth it in man hours if he can get eight accepted at £5000 a time He then draws by hand a final plan for the fitters and this he says no computer can do Minimum orders are rarely under £3000 and the biggest taken so far was £16 000 for a luxury kitchen

The client is then given a typed or handwritten quotation but never a computer printout Quotations are just a little bit too impersonal when computerised he says "If you persuade someone to spend £5000 and then given them a computerised quote it lacks something ' On costing the kitchen the search facility will put out the manufacturer s code and price "Whereas in the past I had a book about 900 pages thick and was always laboriously thumbing through this looking up prices ' he says

'After seeing it twice, my customers understand it.'

On pricing each manufacturer has ten ranges each range may have 900 products giving 9000 prices Of these 900 products, some have never had a test run on the computer and Pollock says this is because no one has ever designed a kitchen using them

The system will now run off the ITT 2020 microcomputer, for which Templeman Software is a main distributor Pollock is thinking of vastly expanding the system by rewriting the programs in PALSOFT but he has since added a graph plotter and a digitizer to the system

For £3000 one gets a simple system but it is expandable by the addition of further disc drives printers graph plotters light pens and of course software says Myles Pollock It is still possible to blow out the program by accidentally keying in a figure too big for the micro to handle Pollock says a program written in Integer Basic is very simple but the programmer cannot trap' errors If the system was written in PALSOFT Basic, then there would be no problem

Just about everything comes off that circuit in the Kitchen Shop showroom Doug Wallis says the one thing that upsets his APPLE is the backspacing on the electric typewriter and the automatic defrost on the fridge I think it is when the contact breaker arcs on the automatic defrost on the fridge that it will suddenly go back into Monitor instead of Basic The information is always there and it is never actually lost At any time a design is saved to disc for security and is automatically preserved at certain key points

Wallis uses his APPLE as an electronic drawing board which is turned on whenever needed which may be two or three hours a day He is not using it for his accounting work because he sees it as a workable tool for drawing and designing only He cites an Australian friend as a good example of someone who knows a great deal about designing kitchens yet knows nothing about computers or Basic After just two hours instruction he learned how to use the computer and to design kitchens from scratch

The people who are afraid of it are the designers because there is no doubt that computers will do the job of three or four designers You will still need a designer for the ideas but computer technology will do the drawing" he says Wallis admits there is a very luddite reaction to the computer, even from kitchen manufacturers who are anti computerised kitchen systems because they say it debases design and takes away some of the mystique

'With the APPLE you don t have to be a draughtsman, you can by any old clot and design a kitchen which would work he says

The computer does take away the necessity to be able to draw to be a draughtsman The antireaction criticism and fear seems to be that the computer is devaluing the product and bringing it within easy access of anybody who wants to set himself up as a design expert Today, there are fewer draughtsmen at the drawing board the man with his light pen and screen is doing the job of five draughtsmen so they could well be a dying breed

In my experience, draughtsmen are prone to inaccuracies so if you can get rid of those inaccuracies why do we need a draughtsman? he asks 'Before the computer it was difficult to be a salesman and a designer all in one But now, you can just sit a salesman down in from the of APPLE He does not have to be able to draw but with the help of the computer he can now design a kitchen ' he adds

Doug Wallis and his wife say they have grown more creative with the computer in place of the drawing board 'To try something creative on the drawing board means you have to rub out a lot of things and if you want to be a little bit slacker you have got to rub out probably half an hour s drawing to then find it does not work When you have done all that three or four times the page is so covered in half rubbed out lines you don t know where you are, so you start on yet another drawing and you eventually end up with about four drawings before you can get anywhere near what you want On the computer you can try it instantly If it does not work you just press a button and away it goes Now I can try things I could never have dreamt of even attempting before ' ■

INCOMPLETE RECORDS ACCOUNTING
tm
# with a PET COMPUTER

Step by step instructions on the screen
AUTOMATIC DOUBLE ENTRY
TRIAL BALANCE
NOMINAL LEDGER
TRADING PROFIT & LOSS
BALANCE SHEETS
for Limited Companies
Sole Traders Partnerships

from
£750 or £5 00 per week

Complete System including.

[illegible]

8k Computer and tape storage	£750 or £9.00 per week
8K Computer tape storage and printer	£1,800 or £12 00 per week
32K Computer disk storage and printer	£2,800 or £19.50 per week

Professional programs also available for — Payroll Sales & Purchase ledgers, Stock control Business Information Building specifications Word processing.

MICRO COMPUTATION
8 Station Parade,
Southgate, London N14 Telephone 01-882 5104

hi-tech electronics
1 Richmond Gardens Highfield Southampton SO2 1RY
Telephone (0703)555072

OUR S 100 COLOUR VDU BOARD

WILL MAKE YOUR [illegible] GREEN WITH ENVY AND OUR COMPETITORS SEE RED AND ANY OTHER OF OUR SPLENDID RANGE OF COLOURS

HIGH DEFINITION FULLY INTERLACED 625 LINE PAL COLOUR VDU BOARD
20 COLOURS AND GREY SCALE TONES INCLUDING RED GREEN BLUE YELLOW MAGENTA CYAN BROWN PURPLE ETC
24 LINES OF 40 CHARACTERS MIXED GRAPHIC AND ALPHANUMERIC
COLOUR GRAPHICS RESOLUTION OF 80 x 72
UPPER AND LOWER CASE DEFINITION OF 8 x 14
ALL CHARACTERS CAN FLASH AND HAVE ANY HUE
SEPARATE BACKGROUND AND FOREGROUND COLOURS
256 DIFFERENT GRAPHIC CHARACTERS
SELECTABLE DOUBLE HEIGHT CHARACTERS AND TWO PAGE MEMORY
1K MEMORY MAPPED TO ANY 2K BOUNDARY
64 PORT PROGRAMMABLE [illegible]
MONITOR OR UHF OUTPUTS RGB TO ORDER
TELETEXT AND PRESTEL COMPATIBLE CHARACTER SET
BRITISH DESIGNED AND MADE

NOW AVAILABLE

PROGRAMMABLE [illegible] DISTRIBUTION BOX [illegible] 8 BIT LATCHED PARALLEL OUTPUT PORT FROM YOUR COMPUTER AND CONTROL [illegible] 2 LEVEL DIMMER [illegible]	£50
S 100 COLOUR VDU BOARD UHF OUTPUT	£265
S 100 COLOUR VDU BOARD MONITOR OUTPUT	£265
S100 8K MEMORY BOARD [illegible]	£210

PRICES [illegible] VAT

COMING SOON
S 100 TELETEXT TUNER DECODER [illegible]

GODBOUT PRODUCTS

HIGH QUALITY, RELIABLE S 100 CARDS AND OTHER PRODUCTS

	Kit	Ass.
2708 EPROM i.c.	£ 7	n/a
2716 EPROM i.c.	£ 29	n/a
Bob Mullen S-100 Bus Extender card with built-in logic probe	£ 30	n/a
Econoram 2708, 16K EPROM card (excludes EPROMS)	£ 55	£ 60
6 Slot S-100 motherboard with termination	n/a	£ 85
SSM SB1 2708/2716 EPROM programmer card with Textool sockets	£ 85	£125
Econoram IIe, 8K memory card	£ 95	£110
Interfacer I/O card, 2 full RS232c serial ports	£115	£145
Econoram VIIa-24K/16K memory card	£165	£185
Econoram VIIa-24K/24K memory card	£235	£255
Econoram XIIIa-32K/16K bank select	£205	£225
Econoram XIIIa-32K/24K bank select	£270	£295
Econoram XIIIa-32K/32K bank select	£345	£375

HIGH PERFORMANCE VDUS AND PRINTERS
Prices include Cables and Securicor delivery

Anadex DP8000 printer, 112 cps, bi-directional, 1K buffer	£ 525
Intertec Intertube II VDU, numerous features, 25 x 80 screen	£ 575
TeleVideo TVI 912 VDU, intelligent compact 24 x 80 screen	£ 595
TeleVideo TVI 920 VDU, as above + function keys, 2 screen memory pages	£ 695
Texas 810 RO printer, 150 cps, bi-directional, full 132 columns	£1325
Texas 820 KSR terminal, features as Texas 810	£1525
NEC 5510 RO Spinwriter, 55 cps, bi-directional	£1795
NEC 5520 KSR terminal, features as NEC 5510	£1995

EXTRA LOW PRICES ON QUALITY BRAND NAME DISKETTES

Pack of ten 5 25" disks	£ 19
Pack of ten 8" disks	£ 23
Ten packs of 5.25" (100 disks)	£175
Ten packs of 8" (100 disks)	£210

MAIL ORDER ONLY

All prices given include postage and packing (overseas add £10), just add VAT. Credit terms (nett 30 days) given to large companies and government establishments. Please write or telephone for further information.

Telephone orders welcome with Access and Barclaycard

LTT ELECTRONICS
8 WALDEGRAVE ROAD LONDON SE19
Telephone 01 828 1785

Access BARCLAYCARD VISA

Th[illegible] [illegible] tant part of Britain's futur[illegible] technology Here Iann Barron [illegible] Inmos gives his company's point of view [illegible] read Martin Bank's article in the January issue [illegible]

Dr R L Petritz Professor I M Barron Dr P R Schroder of Inmos

THE MAN IN THE MIDDLE

Solomon *As you may know I [illegible] up from the small end of the market and so [illegible] here is as much to learn [illegible] — on behalf of the readers of Computer Age and myself Now having followed the Inmos story, it seems to me that the majority of people in the business think that maybe Inmos is a bit late — that [illegible] and two that it might be [illegible] Are these questions you can answer?*

Barron I'm certainly willing to answer them The thing that is often said is that the UK shouldn't be wasting its money on developing semiconductor technology that it should spend its money on *using* the technology It is quite correct to say that this country must exploit semiconductor technology and that the resources of the country ought to be directed towards that end If we *don't* put semiconductor devices into the vast majority of our manufactured goods during the next ten or fifteen years we as an exporting country will have a very serious problem a very uncertain future So that has to be the number one priority

And indeed I spent many years arguing just that initially in terms of computers — that the important thing was to make them and then in terms of semiconductor devices

Having said that there are two further points that need to be made Firstly that view does not say anything about the desirability or undesirability of *making* semiconductor devices The reason why I and my American colleagues started Inmos was because we believed there was a significant commercial opportunity that the investment in a new semiconductor company could lead to a very high financial return So

Solomon *The first motive then is commercial*

Barron We're saying that it's a *good* business That if you can get it right the financial rewards are very large And that was our justification for starting the company

There is however a further view that I would take although I would never use it as a justification for the investment in Inmos That is while we're in the current stage of technology and the exploitation of the technology it is irrelevant whether the semiconductor devices purchased come from the United Kingdom the United States or Japan the amount of silicon going into it is £5 in £500 of material The important thing is to ensure that the resultant *product* is competitive in world markets

However if we look forward — not five or ten but twenty — years ahead then I think we will see the rise of genuine *silicon* products where the major proportion of manufacturing costs is in silicon components The example one might think of in today's terms is a pocket calculator except that when you go inside one the silicon content is very small Nevertheless one can envisage that type of small configuration and inside that a lot of silicon remembering a lot of information with a lot of facilities for the user Now if these appear if the UK doesn't have access to silicon technology it will not be able to compete effectively And the important thing about those markets is that they will be the *new* ones the breakthroughs So a further argument for having the capability in this country is that it offers the potential to get into the businesses that in fact *will* emerge in the future

There is also a third argument which again was not used to justify the investment in Inmos but which does have some force That is, economic history demonstrates that the exploitation of an invention grows up and around the place where the invention occurs and generally countries which have not participated in a basic technology have not benefited from its exploitation So, there's the idea of the *seed of creativity* If you go to Silicon Valley in California there are all these electronics companies growing around the semiconductor industry, where people in the semiconductor industry have an idea and they go out and start something new So there you have the motivation behind starting Inmos Now that didn't actually answer either of your questions

Solomon *No But it's been fascinating*

Barron Which are about being a bit late and a waste of money As far as being late is concerned the essence of starting a company in high technology is to start it at a time of technological change If you can see a point where there is going to be significant innovation then there is an opportunity for new companies to come in We have felt in Inmos that the arrival of very large scale integration is such a point and such an opportunity

That opportunity arrives for two reasons One is that the *method* of manufacturing is changing or has to change substantially in order to make very complex integrated circuits

Solomon *There's a definite break*

Barron There's a break It is necessary to invest in totally *different* manufacturing facilities and by choosing our entry point as we have we can invest in a new facility immediately Our existing competitors have the disadvantage that they have made investments, therefore they are slow to exploit the new manufacturing technology. So they are a bit locked in. The other thing is that, in the market of microprocessors, you have to get to a certain scale of complexity before you can make a really useful device as far as the customer is concerned. Technology is just reaching that level now. And that creates a market opportunity and we're there at the right time.

As far as a waste of money is concerned we have always said that Inmos is a highly speculative venture.

Solomon *Venture capital has been put into it.*

Barron It's venture capital, it is a high risk area, the returns if we're successful are very high and we think that those returns justify the risks involved. What other questions? One is the 64K RAM, the other is the fifty million pounds. I can see it coming!

Solomon *Yes. You've anticipated me.*

Barron Again in relation to this timing. The product which has captured the imagination of the industry and with which Inmos has been tarred — incorrectly — is the 64K dynamic RAM. When we started the company there were cries of, 'Woe! It is too late, it will be delivered in volume by other companies by the start of 1979.' Indeed, one very enterprising journalist wrote that not only was the 64K a product we couldn't compete in, but that there would be 256K dynamic RAMs available before the end of 1979. History has now demonstrated that those statements were over optimistic.

We have been saying that we did not expect the 64K RAM market to emerge before the end of 1980, and not to become substantial before the end of 1981, 1982. The reason we took that view was twofold. One, we knew about the dynamics of the customers in purchasing, and their cycle — which means that they wanted to realise the benefit of their investment in 16K dynamic RAMs. And secondly, we knew that to build commercially viable 64K dynamic RAMs you must invest in a completely new factory with new process technology. And none of our competitors have such a factory. So until that key step is taken there will be no viable commercial supply of the product.

That doesn't mean to say that people won't be able to offer small numbers of 64K RAMs, but these will be made using inappropriate technology, and as a result they are likely to be extremely expensive to manufacture, will be offered at a substantial loss to the manufacturer, and will not be competitive with the 16K RAM.

The analogy I often use is that the technology is like an escalator. The thing that you have to do in designing a product like the 64K dynamic RAM is to choose the moment to step off it. Too late, and there are many established competitors. Too early, and you're in before the technology is sufficiently mature. So typically, within the semiconductor industry the early announcements — up to some critical point — are not really successful. We don't think that critical point has yet been reached.

As to the questions about the scale of investment necessary to operate in the semiconductor industry, this is escalating rapidly and has done so for many years. When Intel began, the investment they required to get going was two and a half million dollars. Zilog's investment in 1974 — undisclosed — was of the order of twenty million dollars. We felt that the scale of investment for Inmos — fifty million pounds, a hundred million dollars — was actually appropriate to the business. It gives us the resources to develop products, lay down major manufacturing facilities. And suggestions that one might require five hundred million or five thousand million pounds are really extremely misguided. Again, if you looked at Intel as a company and you looked at its investment to date in manufacturing equipment and facilities, this was less than fifty million pounds. Indeed, until recently its gross profits in total have been less than fifty million pounds. If you look at Texas Instruments, it has a turnover of one point five billion, it is making large investments, but they are dispersed across a very wide range of semiconductor products, from transistors to change-coupled devices, and also across a very wide range of customer markets. Our investment is very tightly focused on a specific technology and it is a good scale to be at now.

But the interesting thing is that the scale is *going up*. There are very few organisations in the world which have the financial muscle or the ability to make investments of fifty million pounds in high technology. Not only do we think our timing is right, but we think it's going to be very difficult for *further* competitors to enter the business. They will not be able to get that backing.

The idea of investing fifty million pounds in three people is a little bit frightening in some senses, and indeed it is so far as I know the largest single venture capital investment that's been made anywhere.

Solomon *By the way, I am for Inmos. But I regard myself as partly a ringmaster, and will not keep people's opinions out of the magazine just because they differ from my own.*

Barron I understand that, and we find that there's a lot of misunderstanding about what we're at, and about the nature of the business. How on earth can civil servants run and compete in, a business that's as dynamic as this? But of course it isn't run by civil servants. We are really a private company that happens to have a public body, the National Enterprise Board, as its shareholder. But our operation is like that of any other company.

It's often said we have fifty million pounds of financial assistance. We haven't. It's investment on which we have to earn a return. Success means a substantial benefit to our investors and therefore the tax payer ultimately. We have no subsidies, no assistance whatsoever, whereas our competitors in this country, be they GEC, Fairchild, National, Motorola — they have actually got government assistance in the form of grants and other aid. So we are actually at a disadvantage in that respect compared with companies who are nationally well supported.

Solomon *What do you think prompts the people who say the money would be better spent packaging and selling systems?*

Barron Unfamiliarity, a lack of information.

Solomon *Even among people who are supposed to know?*

Barron It's partially just because there are just not enough people to communicate, partially because actually understanding what we are doing demands a fair amount of knowledge about the business, why the business is the way it is, and that doesn't exist a lot in this country.

In the United States there is a proven historical record that the successful companies have been the new entrepreneurial ventures. The ones that have been failures have been offshoots of established companies.

The new, successful ones have been Fairchild, Texas, Intel, I could go on. Then look at the big companies that have tried to get into the business — GEC, Sylvania, RCA, Philco Ford. The only reasonably successful one you can pick out that was large and diversified is Motorola. In that case actually the two bits of the business were very separate.

One can observe all this, but the difficult thing is to decide why. The theory I would have — and it's one that supports the Inmos concept — is that you have to understand and exploit and ride the technology. Go up the escalator, step off at the right moment. So the people running the business must have a fundamental understanding of it, make decisions quickly. Generally speaking, large companies don't meet these conditions.

Solomon *Now an interesting thing occurs to me. You have two American associates — and you're British. Why do you think, given that up to recently it's been an all American show, the three of you got together?*

Barron Well, I think that another aspect of the semiconductor markets of the future will be international. No narrowly based national company will be successful.

The essence of the manufacturing process is high volume. And that means extensive markets to absorb the volume created. The unit investment in the manufacturing facility is escalating, which means the volume necessary to support that also escalates, so that one is looking for larger markets all the time. Any semiconductor company that's going to be successful *must* have a major presence in all the world's markets. And Inmos has started with a presence in two of the three major markets — the EEC and the United States. The actual reason the three of us got together is much more accidental! I just happened to meet Dick Petritz and he just happened to say he was setting up a semiconductor company and asked if I'd like to join them. That was in August 77

Solomon *Do you think that if for no other reason it's still necessary for this country to have Inmos for strategic reasons?*

Barron No I don't. When we had computing technology that was represented encapsulated in vast CDC computers, than having access to that technology — the transfer of that technology — its movement — could be controlled. Therefore it was important to be in the business. The essence of this market is very low cost products made in large volume. It is impossible to control the transmission of those products and I would have no doubt that Russian missiles have American semiconductors in them. So strategically

Solomon *I asked the question because there were some people — myself among them — who were putting this argument forward.*

Barron Well I think if I can now complicate the thing there are forms of semiconductor technology not high volume but specialised which could have some military significance, and which some company like IBM could capture and keep for itself. It would be possible to control the situation so that the technology would not escape. That could have significance through military needs for very high throughputs. But I don't think the vendor type semiconductor technology has any military significance and indeed if you look at the metal oxide silicon business it's been done in spite of the military which in the US has been trying to steer it in directions that suit them — to areas like radiation hardness high reliability very high performance and they didn't see the mass low-cost technology as meeting their needs

Solomon *So this story of the technology being a by product of military investment in the US is not really true.*

Barron Not of the technology I've talked about

Solomon *Can we go on to something else that is you've got a whole team of computer scientists and Martin Banks* has speculated that you are going to attempt to give a more or less complete system to people — a product which has more functions than any other.*

Barron He's entitled to his speculation

Let me add something to what I've just said. We are a component company. We're out to provide components to people who'll use them. We don't expect to supply systems to end users. We would like to make components which are going to better meet users' needs. We think there are much better ways of doing that than the semiconductor industry has achieved so far

Solomon *Do you think that we're reaching some sort of limit to the technology or are we in for advance after advance?*

Barron I actually and this is a risky thing to do tend to feel that yes, we are reaching some sort of limit. Not in terms of what is potentially possible in terms of technology but in terms of what people will *demand* of the technology. Another one of my analogies is that it is perfectly possible to design cars that will go at 200 miles per hour — in fact, that is not what is required of a car in terms of the bulk of users

With information technology you want to be able to make a system. When we have got to the scale of integration which enables us to be able to capture a *system* in a single component, then the advantage of capturing *two* systems in a component rather escapes me. So there is a natural limit to the degree of complexity that will be required. That's not to say that there won't be some systems that require an enormous degree of complexity, but the ninety-fifth percentile will be satisfied by some level so it may not be economic to satisfy the remaining five per cent by developing the technology still further

Solomon *So once the demand limit has been reached that remaining five per cent will be the preserve of the specialist the expert and computing will once more become arcane*

Barron Isn't it at the moment? ■

---

* *Computer Age* issue two

CENTRALEX
LONDON

TRANSLATOR

An instant translator of words and phrases from the world's major languages

Use this amazing Hand Held Microcomputer translator as a

- *Personal interpreter when you travel*
- *Quick reference to most often needed phrases*
- *Metric system converter*
- *Calculator*

Basic Unit £129 + VAT (including 4 languages re-charger and carrying case). Each additional Language Module (for more extensive vocabulary) £24 + VAT. French Spanish Italian Greek & German Calculator Module £24 + VAT

F[illegible]

MICROCOMPUTERS

APPLE
EXIDY SORCERER
ITT 2020
HORIZON

Full support for Hardware and Software
Twelve months parts and labour guarantee
Maintenance contracts
Part exchange welcomed

Centralex London Ltd,
8 17 Lee High Road, London SE13
Telephone 01 318 4213

PRINTERS & VIDEO MONITORS

Printers

- **Centronics**
- **Integral**
- **Anadex**
- **Teletype**

Video Monitors

- **Hitachi**
- **Sanyo**

SOFTWARE– PROGRAMMING–TRAINING

Software

A comprehensive range of programmes and software packages are available (Sales Ledger Purchase Ledger Payroll VAT Data Base System Word Processing COBOL Fortran Stock Control Medical Records Educational Programmes Estate Agents Hotel Reservation System School Administration Building Maintenance Project Management Statistical Mathematical and Engineering Programmes etc)

Programming

Systems Analysis Design and Programming support available

Training

Courses on Microcomputer Appreciation Programming and Systems Design are frequently held

Free Delivery Nationwide – Credit Cards Accepted – Terms Arranged

Centralex London Ltd, PO Box 111 Sidcup Kent DA15 7NY (Callers by appointment only)

Telephone 01-309 7799 01-300 0380

Critique

I have long felt that there is a gap in the computer publications market, for a magazine which covers both the hardware and software aspects of computing at a "professional" level. The current hobby efforts are rather limited, so I was pleased to find an apparently more mature product on the newsagents' shelves. Having bought and read a copy of *Computer Age*, I'm not sure that it is quite what I had hoped for — but it is certainly a step in the right direction. (I would like to have a go at producing something in this field myself but I do not have the necessary contacts or financial resources, unfortunately.) It is early days yet though, so I will continue to buy copies from the shops and decide later whether to subscribe or not.

Despite the above, I must admit that some of the articles in the first (Dec. '79) issue helped to persuade me that I should write to you. (This was before I had seen your bait on p. 84!) In particular, I have an active interest in the field of Machine Intelligence and some of the statements of D. Levy and Professor F. H. George tend to conflict with my views on the subject. (Though hopefully that does not imply that I will be unreceptive to other points of view!)

Mr. Levy dealt with the thorny problem of defining intelligence, using games as a basis for his argument. He seems to believe that machines which can beat chess players (say) are intelligent — but ignores the fact that these same machines cannot make cups of tea, drive a car or have sexual fantasies. In other words, I believe that "electronic brains" need to be *adaptable* (at least) to justify such a title. This implies that an ability to learn is a fundamental and important factor to consider when trying to assess whether a particular artefact is intelligent or not. Such learning ability should be completely general — a contemporary program that "learns" how to play chess will be useless at a game of poker.

When we come to consider just how to build a learning machine, we find that we have little or no alternative but to try and model our own brains (at the information processing level). This is because they have been around for quite a while and are presumably organised in a near optimum manner. (Such a task may seem impossible but I suspect that the low level processes involved are relatively simple. This conclusion is based upon considerations of efficiency in natural systems.)

The Turing test is itself debatable, for I am willing to bet that there will always be observable differences (in the mental sense) between machines and people. Unlike Prof. George, I believe that we will never be able to provide a machine with conative features — because electronic brains will lack any appreciation of quality. So if in a Turing test you ask the artefact concerned to pass qualitative judgement on an original work of some kind, a person should be able to provide [illegible] when a machine would [illegible] its way through it [illegible] tion was not an [illegible] machine could attempt [illegible] sponses given by [illegible] Note that this [illegible] that machines cannot be intelligent [illegible] that they will never appear to [illegible] human-like, which is probably just as well.

Such intelligent machines are a long way off but the potential of computer technology naturally leads me to consider its possible effects on society, so I was pleased to see that you encourage debate on the issues involved. The article by Clive Jenkins was quite a good one but I feel that his outlook is rather narrow. He seems to claim that he is concerned for society as a whole, but trade unions, like most groups, tend to have self-centred interests. For myself, I believe that the so-called Microelectronics Revolution's impact will be similar to that of other new technologies in the past, though perhaps on a larger scale. Much of the discussion on this subject has been irrelevant, simply because there are insufficient numbers of skilled people who can make the vision a reality. It seems to me that the matter has been exaggerated, as there are few significant areas in the software field where the principles of mass production can be effectively applied. What worries me is that our industrialists will not begin to realize the potential of the new technology. I believe that this is because their training often consists of little more than being in close association with their superiors — an incestuous relationship which tends to produce defective offspring. That, together with archaic trade union structure and a two-tier educational system, does present us with a problem. Perhaps the equitable Machine Age will bring about a real revolution.

Some miscellaneous points to end with. Your decision to have a guest professional computer journalist (Martin Banks) was a sound one. This comment that there is a potentially lucrative market for good software is interesting. I might just have a go at that sometime! The article by the psychologist provided a useful insight into the relative merits of various machines, which suggest that you ought to conduct a users' survey of some kind. Other topics that you could tackle include computer crime, the "Big Brother" aspect (such as the potential inherent in System X for tracing calls), concrete applications (ie. detailed accounts of particular implementations) and possibly some fictional efforts. I realise that this letter is rather long but I hope that you find room to print it.

R. D. Prosser, c/o Marconi Avionics, Gads Hill, Gillingham, Kent

Editor's Note Thank you for a fine letter. As for its being long, any letter with the right content is of the right size.

More from Martin

Thank you. It's still a singular pleasure to receive a personal reply. However, from this I feel that some of my original comments need clarifying. I'll make it brief!

A little background info may help to establish my view. I am a senior operator in a very large installation using two top range of IBM 370 series machines. I'm a more than adequate programmer in 370 Assembler (bliss), and to varying degrees in Cobol, Fortran, PL/1 and VS Basic. I've also had hands on experience with a Rockwell Aim 65, Mk14 and experience with 8080 code and PL/M using a cheap assembler simulator.

[illegible] to make is that I got the [illegible] and by my own efforts [illegible] puter science, these [illegible] about programming [illegible] — [illegible] parse chained list processing etc. I agree completely that [illegible] three machines would be [illegible] we do have an independent medium, flow charts. Occasional articles on techniques, or even a small section, would be ideal. I hope you will consider this.

The other thing I want to comment on is that you say your magazine is not intended for the hobbyist. I would not be at all surprised to learn that your first issue was bought almost to exclusion by hobbyists. I certainly did. In my experience, programmers (D.P. staff, systems programmers etc.) rarely buy journals and magazines on computing, preferring instead to receive them free through the post in those little brown wrappers. No doubt it's their fine balance of news and views that makes them ideal for use as clubs and missiles.

We all need relaxation, witness the systems programmer who built an actual flying biplane from IBM 5081 cards and staples, and a magazine such as yours can go a long way to providing this.

But please aim to be the "LANCET" of the computing profession, not the "HOME AND GARDEN" of it.

Martin Crumpton, 36, Nethercote Gardens, Solihull Lodge, Solihull, West Midlands B90 1BL

Editor's Note Martin, what you say turns on what one means by the word "hobbyist". Our magazine is for people with a personal (as opposed to a functional) interest in small computers. Carol Schmulian and Gavin Kenny (Letters, February) captured the spirit of what we're doing by calling *Computer Age* an interface. A £10 book voucher to you. Looks like we're keeping you supplied with literature.

The quick and the dread

Your magazine has made a timely appearance in an atmosphere of quickening interest in the subject of computers outside the circle of those directly involved.

As an interested layman, I have shared with many others a mounting concern about the long term consequences of finding ourselves more and more dominated by machines which are generally little understood, where the motives of experimenters (as distinct from current operators) would seem to be open to question, and some doubt as regards the more extreme claims which are sometimes made regarding the future potential of these mechanisms.

I was accordingly attracted to the article on Artificial Intelligence by Prof. F. H. George in Issue 1. Your contributor appears to have no doubts as to the possibility of ultimately designing a computer which would acquire its own brand of intrinsic (mechanical) intelligence, but in this connection certain aspects would seem to need clarification.

I must confess that I am one of those who has always thought that computers "would only do what you tell them to do — period" and, no doubt, this is sufficient for normal current usage. But the subject of the article was "intelligence", the basis of which would surely require a long and careful process of regulated programming. The fundamental feature of computer programming is, I take it, logic, but to guide a computer up to the point ►

HOW TO SOLVE SYSTEMS PROBLEMS WITHOUT HAVING TO WATCH YOUR LANGUAGE

ZILOG'S MCZ FAMILY. FROM AROUND £4000

The MCZ computer family using Zilog's famous Z80 CPU can solve your problems (or your customers' problems) more efficiently, and economically than ever before

Just look at what Zilog offer

To start the Zilog system is multi lingual Every model has a full five language capability You can move your programs in any language up and down the family at will

Pascal Rapidly becoming a favourite

Cobol For business use — and it s the highest level implementation of Cobol available on a computer in this price range

Fortran Outstanding performance for scientific use at an attractive price

Basic Zilog s version has been extended for both business and scientific applications

PLZ Zilog s own family of systems implementation language

The key to the MCZ family s success is its RIO operating system with features normally found only on very high priced computers

★ Device Independant I O

★ Mid file record insertion or deletion

★ Interactive and batch command input

★ Full set of utilities

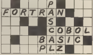
★ Macro assembler

★ Text editor

The range includes the MCZ 1 05 — a low cost floppy disk model the table top MCZ 1 20 or MCZ 1/25 rack mounting floppy disk computers and the highest performer MCZ 1 35 cartridge disk version with 10 MBytes of storage

Software packages are just as new including order entry payroll purchase sales and nominal ledgers stock control forecasting and many more

To back this up Zilog offer full maintenance on software and hardware



For full details of all you need to stay well ahead in tomorrow s world call Zilog Now

Zilog

Welcome to tomorrow's world

Zilog UK Ltd Babbage House King Street Maidenhead Berks Tel Maidenhead (0628) 36131 Telex 848609 where it starts [illegible] must surely require [illegible] the whole circumstance [illegible] knowledge [illegible] carefully and logically implanted

Fine! If all human knowledge had been carefully and logically thought out. But how much of our assurance is based on faulty premises? How many of our scientific certainties will have been abandoned in a few years time?

The very concept of designing and building a machine which we already suspect may ultimately dominate and supplant us may be regarded as the height of folly.

Of course in the end if the confrontation between man and machine leads to open conflict we could always overcome by inducing in the machine an electronic brainstorm brought on by instances of our irresponsible and illogical behaviour deliberate or otherwise.

Thomas Salisbury, 3 Grove Road, Bell Vue Shrewsbury, Salop

- A £5 book voucher goes to the writer

Cover to cover

Many magazines run surveys on items read/not read and liked/not liked. Usually I find I only read and like a few per copy. This magazine I have read from cover to cover and like it all!

J A Dardis, 32 Connaught Avenue, East Barnet, Herts EN4 8PN

CPM Users group (UK)

CPM is widely used in microcomputer systems throughout the country and it has become the operating system for 8080, 8085 and Z80 systems. CPM is normally provided by the supplier of the microcomputer as the operating system needs tailoring to the particular hardware. This wide dispersion of supplies of CPM has handicapped the exchange of ideas between CPM users.

We have formed the CPM Users Group as a non profit making society to provide a forum to encourage and foster contact between CPM users. We are currently planning our first quarterly magazine and we would welcome contributions from any CPM users.

We are also compiling a list of all the micro computer systems and software packages which are available in this country. The society intends to draw up a register of CPM specialists.

D Powys-Lybbe, CPM Users Group (UK), MML, 11 Sun Street, Finsbury Square, London EC2

Good Wishes

Congratulations on a first class issue!

May we use your columns to bring our Club to the attention of your readers?

SELMIC (the South East London Microcomputer Club) is South London's Premier micro club with some 170 members forming a large variety of special interest groups (TRS 80, PET, NASCOM, Business, Education etc.)

We are independent of, but hosted by, Thames Polytechnic of Woolwich, South London, with whom courses and the use of additional resources are currently being negotiated.

Our meetings are generally held on Wednesdays between one and three times a month. Basic subscription is £5.

Members range from novices to experts and are of a wide variety of backgrounds and interests. New members are sought and are welcomed. The larger our membership, the more we are able to meet the personal requirements of individual members by introducing them to people of similar interests whether those interests or problems be regarding common hardware, software or applications.

Club contacts are

John Williamson (Chairman) 01 850 4165
Malcolm Beresford
(Membership Secretary) 01-698 1422
Hugh Gillespie
(Treasurer) 01 303 4968

Thank you, and may we wish every success to your magazine.

John P Williamson, FCA, Chairman SELMIC

Editor's Note This letter shows quite clearly that computer clubs nowadays are not necessarily only for the hobbyist.

Advertisers' Index

Act Microsystems 48 49
Act Petsoft 11
Almaro Data Systems 22
Centralex 77
Colin Bentley Associates 51
Comart 32
Commodore (Dealer Network) 40
Competence 18
Computerame 59
Datron of Sheffield 17
Equinox Computer Systems 15
G W Computers (Grama/Winter) 36
A J Harding (Molimerx) 4
Hi Tech Electronics 41 74
Interam BC
Jacobs Computer Systems 4
Kingston Computers 6&7
LP Enterprises 62,63
LTT Electronics 74
Landsler Software 12
Logitek 45
Micro Centre 2
Micro Computation 74
Micro Management 27
Microdigital 4
Micromedia Systems 1
Microsolve Computer Services 35
Mine of Information 41
Modata 41
Rohan Computing 44
SEED IBC
Systems Plus 31
Tektronix (UK) IFC
The Software House 12
Vector Computer Systems 18
Xitan Systems 18
Zilog 79

DON'T MISS OUT ON THE Computer Age

I wish to take out a subscription to *Computer Age*. Please forward the magazine each month starting from issue (   )

Name
Address

Signature

I enclose a cheque/postal order for £7.20 (Please make payable to *Computer Age Limited, 4 Valentine Place, London S E 1*)

Computer Age has rapidly become the magazine people both read and use as a reference. We have set the pattern from the first issue and are making it even more attractive to people like you who have an interest in the computer scene.

So if you have enjoyed this issue, why not guarantee your copy each month (before the magazine reaches the shops) by taking out a subscription? Twelve issues will cost you just £7.20. (We'll take care of postage and packing costs). Seems a small cost for keeping in touch with the significant applications in the constantly changing computer age.

Note: If you wish to keep this page intact, please send a photo copy of the coupon or a separate letter instead.

All Systems Are Not Created Equal

Your computer application is unique It differs from all others It is because not all applications are equal that MSI has developed a variety of computer systems

At the heart of every MSI System is the powerful MSI 6800 Computer one of the fastest and most versatile available Depending on the System you select, the MSI 6800 has from 16K to 56K of RAM Mass memory storage in MSI Systems range from 315K bytes in the System 1 to over 10 megabytes in our most powerful System 12

In addition to the computer and memory subsystem MSI Systems include a CRT terminal and high speed character printer The System 12 is housed in a compact desk unit

As with hardware computer software is not always created equal Since there are a myriad of programs available MSI offers a choice of Operating Systems for use with your MSI Computer System Of course our favourite is MSIDOS but we offer the powerful SDOS operating system as well All MSI Systems will support the other software products associated with each operating system

MSI also has a variety of software programs including a Multi User Basic program capable of supporting up to four users

MSI Systems are currently being used in a broad spectrum of personal scientific educational professional, and business situations In addition to our Systems we can supply you with individual components for personal and OEM use All MSI System components are available, some in kit form.

Write or call us for more information about MSI Systems and products and the name of your nearest MSI dealer

seed

Strumech Engineering
Electronic Developments
Portland House
Coppice Side Brownhills
BRO 4321 Telex 335243

North Star Horizon–

THE HIGH PERFORMANCE COMPUTER

The North Star Horizon computer can be found everywhere computers are used: business, industry, education and even in the home. Low cost, performance reliability and software availability are the obvious reasons for Horizon's popularity. Over 15,000 users during the past two years have proven that the Horizon has the reliability for day-in, day-out computing. Available software includes word processing, general ledger, sales and purchase ledger, inventory, time ledger, incomplete records, timesharing BASIC, PASCAL, FORTRAN, COBOL, PILOT, PDS, CP/M etc

NOW BETTER THAN EVER !!! — The new Horizon configurations now include a minimum of one drive (dual or quad), 32K RAM, two serial and one parallel port, full complement of 12 S-100 connectors and rear additional drive connector. The Horizon is now available with double-sided dual density drives giving 360K of storage per drive. The new drive has the additional advantage of increased speed (5ms t-t access as opposed to 40ms)

Please write or telephone for further details or send 25p for full product catalogue and pricing information

Dealer enquiries welcome — Educational/OEM and dealer discounts given

Basic System	
Horizon 2-32k-D-asm	1545
Anadex DP8000 printer	525
Intertec Intertube II VDU	575
System complete with cables	£2645

Sample configured prices	
Horizon 1-32K [illegible]	[illegible]
Horizon 2-32K [illegible]	[illegible]
[illegible]	[illegible]
RAM-[illegible]	[illegible]
RAM-32k-[illegible]	[illegible]
Floating point [illegible]	216
CP/M for North Star	75
NS PASCAL [illegible]	[illegible]
[illegible] 50 [illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
NEC Spinwriter [illegible] printer	[illegible]

INTERAM

UK distribution
INTERAM Computer Systems Ltd
[illegible] Street
Victoria London SW1V 2NY
Tel: [illegible]
Telex: [illegible]